ELECTRICAL REVIEW

[ILLUSTRATED]

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Electrical Meters.

At the last reunion of the *Elektrotechnisches Verein*, at Berlin, says the *Lumiere Electrique*, the subject of measures of electrical energy was very thoroughly discussed by Dr. H. Aron, who has himself recently invented two apparatuses of this nature. The rapid development of electrical industry and the growing number of applications render the subject of a meter of electricity, which shall perform for it what the gas meter does for gas, a very important one from a practical point of view. We call all these instruments measurers of electricity, although, in fact, they should be divided into two very distinct categories. What is required to be counted in a system of distribution of electricity is the quantity of energy furnished to a consumer during a given time. This energy, whether expended in the form of light mechanical work, chemical work, or any form, can always be expressed generally as the product $E\,I$ in voltamperes during the unit of time; E being the difference of potential at the apparatus which is to utilize the current, and I the intensity of circulation, expressed, the former in volts, and the latter in amperes. It results from this that for a given period of time the energy expended may be expressed thus: $\int E\,I\,dt$. If one is obliged to work with constant difference of potential, E becomes a constant factor, and the electrical energy is expressed simply as $\int I\,dt$. Thus there are two very distinct classes of measures of electrical energy; one registering the quantity of electricity which flows through a conductor during the interval of time considered; and the other giving the value of the integral $\int E\,I\,dt$; the first class might be called coulomb-metres, and the second voltampere meters, or more simply measures of energy.

There are quite a number of coulomb-meters. Among the first rank are those based on electrolytic actions; when the current of electricity is passed through a quantity of acidulated water the quantities of hydrogen and oxygen set free may be used to measure the quantity of electricity which is flowing. Messrs. Sprague and Edison have both conceived the idea of using electro-chemical deposition for working meters of electricity. Figure 1 illustrates a very simple representation of this class composed of two voltameters of sulphate of copper $V\,V'$. The electrodes are placed in a shunt from the main circuit, regulated by means of the resistance coils $r\,r'$, so that the quantity of current which traverses it shall be, generally, only one hundredth of the total.

The major portion of the current passes by the large zig-zag conductor R or else through the lamp situated under the voltameters when it is feared that the temperature may be low enough to produce congelation of the liquid. The use of the apparatus is very simple, the deposit of copper is proportional to the quantity of the current and to the time occupied in making the deposit; it is sufficient, then, to know the proportions of the currents to each other, and to weigh the deposits.

The annual report of the Missouri & Kansas Telephone Co., on page 6, is very creditable to Mr. Phillips' management, and indicates a promising future for well-managed sub-companies.

The Secondary Generators of Gaulard and Gibbs.

In electro-technical circles it is in serious contemplation to effect the distribution of electrical energy from central stations, not by means of accumulators, but by secondary generators. The apparatus, so-called, in the stricter acceptation, are, in their present form, induction bobbins with flat spirals pressed into each other. The primary spiral consists of flat annular plates of sheet copper, one-fourth millimeter in thickness and 3½ centimeters in width. At the point where they have to join up to each other there is an eye in a kind of projecting tooth. This serves to connect the first annular ring to the second, which is again connected in the same manner to the third, and thus the primary spiral is composed of a series of such plates.

Between each two annular plates, which

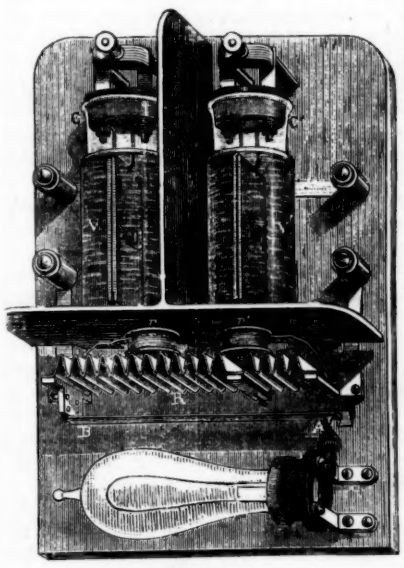
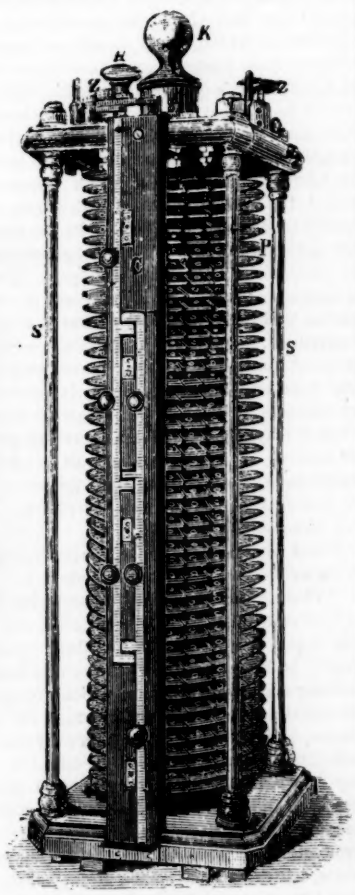


Fig. 1.

are left bright, there intervenes a plate of the same metal and the same size, belonging to the secondary spiral, covered with a black insulating mass. Between the black and the bright copper plates there are further introduced rings of parchment as insulators. Thus a column, constituting a secondary generator, is formed of a great number of such flat rings. The first, third, fifth, etc., form the primary, whilst the second, fourth, sixth, form the secondary bobbin. There passes through the former the inducing current of very high tension (2,500 to 3,000 volts have been mentioned). The secondary column can be put together at pleasure, the flat rings being arranged either in succession or side by side, as convenience requires. The accompanying figure shows the form of the generators as exhibited at Turin.

Between the supports, S, S, fixed on a wooden foot, the primary and secondary plates, P, are arranged as a column. The eyes, which serve to connect each two consecutive rings, are visible in the figure. Z and Z are the clamps for introducing the primary current; H is the handle for connecting or disconnecting the induction coil. The metal core, K, serves for increasing or diminishing the induction, according as it is pushed more or less deeply into the induction bobbin. The inventors are attempting to produce this effect by an automatic arrangement, and thus obtain a spontaneous regulation of the currents. The plates visible on the front bar, c, contain the connections for the secondary currents, which may be derived at pleasure for arc or for glow lights, or for both simultaneously.

The deviation for these different purposes is very convenient in this apparatus. The useful return of the secondary generators,



Gaulard and Gibbs' Secondary Generator.

though not yet precisely determined, will be considerably higher than in any previous apparatus of this kind, on account of the ingenious utilization of the inductive action of the primary upon the secondary bobbins, and probably higher than in accumulators.

Still, this apparatus has its weak side, which we must at once point out. The greater the resistance in the secondary circuit, *i. e.*, the more work there is thrown upon the secondary generators with a parallel arrangement of the lamps, the less is their performance. If we plot out the curve of work performed at different resistances (regarded as abscissae), it would appear, on employing the existing means of regulation, as a line inclined towards the axis of the abscissae. But the desired object, *i. e.*, to make the work perfectly proportional to the demand, is not attained.

In addition to this property of secondary generators, opponents of the invention have succeeded in pointing out other defects. The measurements undertaken by Dr Hopkinson in London, in the middle of March last, have shown an electrical result of 86–89 per cent. In these measurements Dr. Hopkinson himself, though no opponent of the generators, perceived that, if only a portion of the working apparatus is utilized, the result of the active columns is deteriorated, since another portion of the work remains useless in the inactive columns. It must be remarked that in that result (89 per cent.) the 3,630 volt amperes, which are absorbed by the resistance in the circuit, are included as useful work. Certainly, these volt amperes are also added into the value, which expresses the total work. Still, as Hospitalier points out, it is more useful than fair, in valuing the effect, to add one and the same number both to the numerator and the denominator of the fraction expressive of the yield of the apparatus.

Besides Hospitalier, Bright and Gordon rank among those who consider the apparatus of Gaulard and Gibbs as in part not new and in part not remunerative. The more recent form of the apparatus may, however, claim a different judgment.

It is well known that at Turin most satisfactory experiments have been made with secondary generators. The inventors claim, as the most prominent, the essential purpose of their construction, the possibility of the distribution of electric energy, and in this exhibition they have shown themselves so close upon the attainment of this object that a sum of 10,000 francs and a gold medal were awarded to them as an encouragement to persevere in the direction they have taken, and as a reward for their achievement. This prize was a portion of the sum of 15,000 francs which the Italian Government had offered for the best result in applied electricity.

The experiment itself was as follows: In the exhibition building stood a Siemens alternating current machine, which required to be actuated by 30 horse-power; in the kiosk of the *Figaro*, in a court of the exhibition space, was a small secondary generator supplying 5 Swan lamps; in the Turin railway station there were 34 Edison lamps of 16 normal candles, 48 at 8 normal candles, and a Siemens arc light. At the station Veneria Reale there were 2 Siemens arc lights; at Lanzo, a small village in the Alps of Savoy, there were burning 9 Bernstein lamps, 16 Swan lamps at 100 volts, 1 Sun lamp, and 2 Siemens arc lights. In the vicinity of the alternating machine, in the exhibition building itself, 9 Swan, 9 Bernstein, and 1 Sun lamp were supplied by the secondary generators placed there. These various places were connected by a wire of chrome-bronze of the conductivity of 98 per cent. (electrolytically pure copper = 100). This wire, which had been lent by the firm Monchel, of Paris, was 3.7 millimeters in thickness, 80 kilometers in length (including the return conductor), and was supported on ordinary telegraph posts. The working was carried on undisturbed for 5 hours, and was considered worthy of the rewards above mentioned. The jury, including men like Tresca, Weber (Zurich), Ferrini, Ferraris, Wartmann, Voit, and Kittler, expressed

themselves as follows: "Though the conversion of feeble currents into strong ones by means of induction is not novel, the jury admit that the most recent form given to the induction apparatus by Gaulard and Gibbs is the most rational, and effects the transformation with the smallest waste. It was resolved to award 10,000 francs to these gentlemen, to to be applied to the further development of a system so suitable for distributing the electric light over extensive districts."

The measurements undertaken at Turin are said to have shown, with these generators, a useful effect of 90 per cent In judging this percentage, we must remember that it depends on the values introduced into the numerator and the denominator of the fraction, and that a complete and clear statement of the methods of measurement employed has not yet been furnished. These methods do not seem to afford an accuracy free from all objections Professor Galileo Ferraris, during the exhibition itself, which was prolonged far into October, was engaged with determining the useful effect of the generators calorimetrically.

The measurements undertaken by the jury refer to a generator arranged to furnish 2 electric horse-power (1 492 voltamperes). The primary current had the strength of 12 amperes, and traversed a resistance of 11-8 ohm. The apparatus consisted of 1,000 of disks above described, of 12 centimeters exterior diameter; the diameter of the internal section was 5 centimeters, and the thickness of the plate was one-quarter millimeter. The column had a total height of 55 centimeters, and a diameter of 15 centimeters. For the construction of the secondary generator were required 20 kilos of copper, and hence a cost of 60 francs—a very small outlay for an apparatus capable of feeding 18 to 20 lamps at 16 normal candles. This price is trifling in comparison with that of accumulators. A closer examination and a more frequent application of this apparatus will best show its value.

The communication made by Tresca to the Academy of Sciences on the Turin experiments was characterized by great reserve. It closed as follows: "The purpose of the statements made is merely to show that it has been found perfectly possible to carry out several methods of illumination in a circuit extending to 40 kilometers from the place where the current is produced. The importance of this fact demands the verification of the data concerned. It must be remarked that we have nothing to do here with a transfer of mechanical power."—*London Electrical Review.*

Electric Telltales.

RECORDING TEMPERATURE IN DISTANT PLACES AND ABLE TO DETECT ICEBERGS.

Cling-aling-aling-ling-ling! "Confound it!" exclaimed the house physician of one of the large up town hospitals, springing out of his chair as he heard the ringing of the bell. "You'll have to excuse me a moment; they're letting the temperature in the contagion ward run too high."

With that he hastily left the room.

During his absence the reporter, who had been sitting with him, looked in the direction from which the ringing sound had come. The only clue to its origin was an instrument apparently affixed to the wall, and seemingly consisting of only a dial plate graduated like those attached to metallic thermometers, with a movable dial hand and two subordinate hands, which looked like the alarm hands on a clock. One of these had just been touched by the main hand, the contact having evidently set the bell ringing. While the reporter was looking at the instrument there was a sudden clack-clack, clack, and the dial moved back three degrees, which would indicate, if the instrument were a metallic thermometer, a corresponding fall of temperature. But on going close up to the wall, so that he could see behind the plate, the reporter noticed what appeared to be an electrical attachment, from which wires ran into the wall.

While he was still puzzling over the instrument the house physician entered again. "There," he said, looking at the plate over which the hand had moved back several degrees more, "the temperature's all right now. I've had them let some fresh air into the ward. I suppose," he added, as he saw that the reporter was examining the instrument, "you wonder how I found out while sitting here that the temperature in the contagion ward was running too high, I discovered it by glancing at that dial plate. The temperature of the room in which the patients lie is recorded on a thermometer in that room, and transmitted to that plate. I can sit here and read it off. If I happen to be busy with my books I can set the alarm hands at the degrees above or below which the temperature should not rise or fall, and be notified by the ringing of the bell, just as I was now, that something is wrong, whenever either extreme is reached by the dial hand. It's a new and ingenious invention."

"How does it work?" asked the reporter.

"By a contrivance which is elegant in its simplicity. It is partially the invention of a friend of mine, Robert Hewitt, Jr., who hit upon the idea that such an instrument would be useful, and then handed over the idea for development to Charles L. Clarke, formerly chief engineer for Edison. Mr. Hewitt was interested in an enterprise which required him to visit cold storage warehouses and refrigerated vaults. He soon began to feel the disagreeable effects of emerging from the extreme cold of the warehouses and vaults into ordinary temperature. Then the thought struck him that if an instrument could be constructed which would record the temperature in these places at some convenient spot in the manager's or superintendent's office, it would be of great use in this and other industries. He felt intuitively that electricity would accomplish this purpose, and so called in Clarke. He has devised an apparatus called the telethermometer, which may be briefly described as follows: In the room, the temperature of which is to be recorded, is placed a metallic thermometer. This is connected by wires with a dial plate like that on the wall there, located wherever it is most convenient. With the contraction or expansion of the metals in the thermometer the dial hand on the instrument vitalize a series of magnets which, acting through the wires, vitalize magnets back of the receiving plate or receiver, as the dial on the wall is called, and thus causes the hand upon the receiver to move absolutely in unison with that on the thermometer."

"And what is that strip of paper hanging from a roller beneath the dial plate?"

"That's a neat appliance for rendering the record permanent. By a mechanical device the paper is continually unrolling, and a pencil is kept moving with the dial hand, making marks on the paper, which thus preserves the record. It enables me, for instance, if I am called away from duty and a substitute is put in my place, to discover, on my return, if the temperature in the ward has been allowed to vary too much one way or the other. Moreover, the paper is so graduated that it shows not only the temperature, but the hour at which it prevailed, so that I know upon whom among the employes in the contagion room to place the blame, as a record is, of course, kept of the hours when each employe is on duty."

"I should think," suggested the reporter, "that such an instrument would have other uses besides in hospitals."

"Wherever temperature is of consideration it can be applied," said the physician. "Capt. Murray, of the Alaska, was in here this morning to see if it could not be utilized by navigators in the North Atlantic. You know that ever since the Arizona bumped against an iceberg, without injury to the berg and considerable damage to the ship, seafaring men have dreaded the floating mountains of ice more than ever. The best indication of the proximity of icebergs is the increasing cold of the water. To continuously dip a thermometer into the sea would obviously keep one man at work all the time. Capt. Murray recognized at a glance that the telethermometer would obviate this. The idea is to place the metallic thermometer in the induction pipe, through which all the sea water for the use of the vessel passes, and connect it with a recording dial on the bridge, where the temperature can be read off by the officer on duty. It could be used, moreover, in deep sea soundings to determine the temperature of water at varying depths, or it could be placed on mountains or at points where it is impossible to maintain signal stations, and the observations could be recorded at a central station. Its prettiest application, however, will be in detecting smouldering fire in buildings or ships. The thermometers can be located in various parts of the houses or cargoes, under floors and beams, among bales and barrels, and a person in the observation room can be informed of any rise above the normal temperature at any point. Its use in grain elevators, hothouses, and so on is obvious.

"In this room here," continued the physician, leading the reporter into an adjoining room, "you will see two variations of the instrument, called respectively a telehydrobarometer and a telemanometer. The first records water pressure at distant points. For instance, the water for our hydraulic elevators is supplied from tanks It is important that the water in these tanks should not sink too low or rise too high. Here you see indicated on the dial the number of feet of water in the tanks. If the water should give out and the elevators fall, the record on the paper would show at what moment the accident happened. This instrument is in use by several companies employing water power, to indicate the height and pressure of water at their dams. The telemanometer indicates and records steam pressure. A chief engineer of a steamship, when off duty, can sit in his cabin and tell by a glance at the receiving dial plate if all is going well below. Here we use the instrument to indicate and record the pressure in our boilers. The system on which the instruments are constructed is called telemetry."

The Light That Will Extinguish Gas—The Cost and Revenue of the Great Systems in New York—Some Interesting Figures.

Prof. Preece, the English scientist, lately stated before the Society of Arts in London: "I know nothing more dismal than to be transplanted from the brilliantly illuminated avenues of New York to the dull and dark streets of London. On the evening of Oct. 21, I drove from the Windsor Hotel, New York, to the Cunard Wharf, a distance of about four miles, through streets entirely lighted by electricity. On Oct. 30 I drove from Euston to Waterloo without seeing a single electric light, having been on the ocean during the intervening period."

The adoption of the electric light by America, and especially by the people of the United States, to the extent which renders contrast with England so decided as to elicit such a remark from the noted F. R. S., is not singular; the New World is far more prompt to "catch on to" a good thing than the old country, and, once started, a really important invention never lacks capitalists to push and patrons to employ it. But the electric light is comparatively so new and our country so vast, that few have any more idea of the extent of its employment, the immense capital invested, and the strides it is making in popular favor, than they have of the science of electricity as applied to everyday use and the details of the electric light which is now a familiar sight to their eyes.

In this country was first solved the question as to whether electrical lighting as a means of general illumination could be made to pay. It is believed that in a short time the price of the new light will be so reduced as to be less than that now paid for gas. In the Brush system the output of the dynamo, furnishing the current, has been so extended that sixty-one lamps are now lighted where only forty were supplied by the earlier machines. The distribution of the current by a net-work of double mains or "metallic circuit" involves the use of an immense weight of copper, but Mr. Edison and Mr. Weston in America, and Dr. Hopkinson in England, have effected an economy of 60 per cent. in this particular by using three wires and two dynamos, materially reducing the cost of a plant.

In regard to the extent to which this great invention is employed in large cities and small towns a few statistics will give a fair idea. In New York, Philadelphia, Boston, Buffalo, Cleveland, Chicago, St. Louis, Montreal, Indianapolis, the principal streets and warehouses, stores and places of public resort are lighted by arc lamps, and these are but few of the many places and establishments that might be mentioned. There are certainly 100,000 arc lamps alight every night in the United States. In Chicago the number of arc lamps increased from 1,000 to 2,000 inside of twelve months. The capital invested in New York City alone is over $1,000,000, and the stations find it impossible to supply the demands for lamps. At Roselle, a small village in New Jersey, 1,200 incandescent lamps are used; at Brockton, a town about seventeen miles from Boston over three thousand incandescent lamps are supplied. On ferry boats, United States naval vessels, the hotel steamers of New York's rivers, Lake Superior and the Mississippi, the electric light has been generally introduced, and all the great steamers carrying passengers across the Atlantic have been or are being fitted with plants. The great Brooklyn Bridge is lighted by eighty-two Weston arc lamps, and the view of this magnificent structure at night from Staten Island and the harbor of New York is one of the grandest optical effects ever beheld. The entire harbor of this city is rendered by this means so beautiful, in a scenic sense, that one of the enterprising ferry companies contemplates having nightly excursions during the summer season, which it is intended to advertise as the "Theater of New York Harbor by Electric Light; price of admission, 10 cents."

The systems of lighting may be classified as the arc and the incandescent, and these are under the names of the Brush, the Weston, the Thomson-Houston, the Vandepoele, the Western Electric, the Remington, the McTighe, the Sperry and the Edison. There are standard Weston machines for working arc lamps, and also for working incandescent or "globe" lamps, the former being supplied with a most sensitive regulator, which adjusts the strength of the shunt current or field magnets so as to maintain the current in the main line constant, and the arrangement of the dynamos for glow lamps allows 199 lamps out of 200 to be suddenly extinguished without producing any change in the incandescence of the one left burning.

Regarding the reliability of the light, the experience of the Edison Grand Central station in this city is sufficient. It was opened in September, 1882, and during the whole of the period that has elapsed from that time to the present there has only been two and a-half hours' stoppage, and that was due to carelessness. The price charged is about the same as that which would be paid if gas were supplied at $2 per 1,000 cubic feet, and still the system is worked at a profit. During the past year the balance on the right side has been sufficient to pay a dividend of 3 per cent. on the capital invested, though no dividend has yet been declared. The earnings of each lamp are 1.04 cents per hour, while the cost of production is 75 cents. The average number of hours is 2.4 per day per lamp. A record has been kept of every lamp, and the average life of each amounts to about 477 hours.

Probably the most interesting detail in connection with this subject is the means for measuring the current used. This is done by noting the electrolytic action of the small portion of the current, upon two zinc plates, one positive and one negative, immersed in a solution of sulphate of zinc. Bottles containing the solution and the zinc plates are supplied to customers of the Edison system, the invention being one of the many perfected by that genius. These bottles are collected every month, and in New York two men are employed whose sole duty it is to gather and measure these "meters." The plate which has suffered loss of zinc is

removed from each bottle of the meter, dried and carefully weighed. The mean between the two measurements is taken as the true one, and this weight of zinc lost, in milligrammes, multiplied by a coefficient, gives the number of dollars to be charged for the light consumed during the month. The charge made to the consumer, though based on the current supplied, is really charged on the light given, and is $1 per 1,000 candle hours. The weight of zinc lost is made equivalent to so many candle hours, and the subscribers, therefore, pay for the light they receive and not for the current they use. There are about 1,200 bottles out, fifty of which are measured every day.

The new tower with its lights at Hell Gate, representing an aggregate of 54,000 candle power, is the first step towards revolutionizing the entire lighthouse system of civilization. The amount of capital and labor employed in the electric light production, directly and indirectly, can hardly be computed, and the increase is continual and large.

The question of lighting railway trains by the electric light has been successfully solved and railway carriages have been by it illuminated for the last twelve months. One very successful plant places the dynamo and its high-speed engine on top of the locomotive in the rear of the dome, and clear of the side view of the engineer, the steam being furnished from the locomotive boiler. The engine, of ten-horse power, weighs only fifty-seven pounds, the dynamo makes 1,000 revolutions per minute, and the whole affair, engine, dynamo, bed and attachments, weighs but 350 pounds and occupying a space three feet long, thirteen inches wide and standing two feet in height.

The Electric Railway as Applied to Short Lines.

By John W. Beane.

It has been pretty generally conceded that, for the present, except in special cases, as for instance, on the elevated railroads of this city, this system of locomotion will be applied solely to branch lines or feeders. In estimating its possibilities this fact must be kept in view. Many claims have been urged in favor of the electric railway, some of which are absurd, some extravagant, but most are well founded. The more important are :

1. That by a reduction in the total weight of the train by reducing the weight of the motor, we obtain a consequent reduction in the weight of rails and structures.

2. That this reduction in weight decreases greatly the general wear and tear of the road and equipment.

3. That a system of single coach dispatch is permissible and that it constitutes a factor of safety when collision is threatened, or in event of its occurrence—thus doing away with long trains and securing extended facilities of travel.

4. That the cost of maintenance is less than with steam.

In all the systems thus far brought forward prominently the train consists of a motor, leading, followed by one or more cars. In these cases the electric locomotive, as it carries neither boiler nor tender, gains a reduction in weight over the steam locomotive of over 50 per cent., but in reducing the weight of the motor its tractive power is not lessened, as would ordinarily be the case with a steam motor, for there is an attractive action between the wheels and the rails due to the passage of the current, which performs the function previously performed by the force of gravity.

With regard to the weight of cars, it is not probable that any material reduction would be made since they are now built to a strength and weight determined by many years' experience, sufficient to resist, principally, hauling and buffing strains. A reduction, however, of about 15 per cent. in the weight of rails would be permissible.

On short lines such as invite the use of electricity for motive power the grades are likely to be heavy, and the curves sharp, which would require the use of proportionately heavy engines, and since the weights of rails and bridges are dependent principally upon the weight of engine upon drivers, proportionately heavy rails and bridges must be used. Now, with undulating grades, no matter how steep, and with electricity for motive power we may, provided we so regulate the running of trains, eliminate the question of grade from the problem as explained by Sir Wm. Siemens in discussing the inter-action of prime and counter currents: "If two trains should be placed on the same pair of rails, the one moving upon an ascending portion, and the other upon a descending portion of the same, power would be transmitted through the rails from the latter to the former, and the two might be considered as connected by an invisible rope."

Grade eliminated, there will not be so great a tractive power required; thus the weight upon the drivers may be reduced, and a consequent reduction made in the weights of rails and bridges.

As the weight upon the drivers is the most important factor in the wear and tear upon rails and structures, speed remaining constant, we may confidently count upon a very satisfactory reduction in this important item of expense.

It does not seem likely, except upon roads where the traffic is extremely light, that the system of single passenger coach dispatch would prove feasible owing to the variable requirements of freight traffic; its employment in general freight transportation would seem to be precluded owing to extra expense, in point of attendance, if nothing else.

In view of the fact that a small electric motor is as efficient as a large one, advantage could possibly be taken of this fact to do away with a leading motor and attach a small motor to the axles of each car, all operated from one point by one engineer. Though the electrical difficulties attending this arrangement are numerous, yet they do not appear insurmountable. This plan would almost entirely neutralize curve resistance as well as minimize the consumption of power, which must occur by the attractive action between rail and wheel.

To correctly estimate the saving in cost and gain in efficiency of electric roads over steam roads a typical case as nearly general in its application is necessary.

Assume :

The length of road (heavy grades and sharp curves).=60 miles (single track).
No passenger engines in use at once.....= 7 miles (single track).
No. freight engines in use at once....= 7 miles (single track).
No. passenger cars to train.....= 3 miles (single track).
No. freight cars to train.....=10 miles (single track).
Weight of passenger cars (loaded) maximum.....=18 tons.
Weight of passenger cars (loaded) average.....=16 tons.
Weight of freight cars (loaded)=20 "
Weight of car separate.....=10 "
Weight of rail (per yard).....=65 lbs.
Average speed passenger trains.....=20 miles per hour.
Average speed freight trains.....=10 miles per hour.
Weight of passenger engine, on driver.....=25 tons.
Weight of freight engine on driver.=34 "
Maximum grade per mile.....=105 feet.
Average " " " .....= 60 "
E.M.F. of generators.....=2,000 volts.
Three generating stations supplying 10 miles each way.

STEAM POWER.

The *maximum* power that could be required of the 7 passenger engines would be 1,855 horse-power.

The *average* ditto 958 horse-power.

The statement will then be as follows, taking the hour as the unit of time :—

Interest and depreciation—7 passenger locomotives at $11,000—at rate of 15 per cent. per annum.....=$ 1.31.
Wages of 14 attendants at $35 per diem.....= 1.45.
Coal for 7 engines at $3 per ton—12 lbs. per horse-power.....= 17.22.

Total per hour (passenger trains)..= $19.98.
The maximum power that could be required of the seven freight engines.-.....=2,621 H. P.
The average, ditto.....=1,365 "
The statement will be :—
Interest and depreciation—7 freight locomotives at $12,000—at rate of 15 per cent. per annum.....=$ 1.43.
Wages of 14 attendants—at $35 per diem.....= 1.45.
Coal for 7 engines at $3 per ton, 10 lbs. per horse-power.....= 20.46.

Total per hour, freight trains.....=$23.34
" " passenger " .....= 19.98.

Grand total of cost per hour (steam)=$43.32.

COST OF MOTIVE POWER.

Seven passenger locomotives, at $11,000.....=$77,000.
Seven freight locomotives, at $12,000.....= 84,000.

Total .....=$161,000

ELECTRICITY—USING A LEADING MOTOR.

The reduction in weight of motor (electric locomotive)..=50 per cent.
The maximum power that could be required of the 7 passenger locomotives.....=1,575 H. P.
The average ditto.....= 798 "
The maximum power that could be required of the 7 freight locomotives.....=2,429 H. P.
The average, ditto.....=1,183 "
Total horse-power possible....=4,004 "
Maximum power required from 6 generating dynamos.....=8,000 "

COST OF MOTIVE POWER,

taking the hour as the unit of time, as before, the statement will be as follows, estimating the power recovered by the train motors from the steam engines at 50 per cent.

Interest and depreciation at 10 per cent. per annum.....=$ 5.82.
Coal for 3 engines, each 1,321 H.P. at 2 lbs. per H. P., costing $3 per ton .....= 11.88.
Wages at power station.....= 6 50.
Twenty-eight attendants to trains at $70 per diem.....= 2.92.
Total cost per hour.....=$27.12.
Six generating dynamos, each about 1,339 H. P, at $34,000, including cost of erection.....=$204,000.
Three steam engines and boilers, each 2,669 H. P. at $50,000, including cost of erection.....= 150.000.
Three power houses at $10,000..= 30,000.
Seven passenger locomotives, each 225 H. P. at $7,000.....= 49,000.
Seven freight locomotives, each 347 H. P. at $11,000.....= 77,000.

Total cost of motive power (electricity).....= $510,000.

USING SEPARATE MOTORS ON EACH CAR.

The maximum power that could be required of the 21 motors of passenger trains..=1,267 H. P.
The average, ditto.....= 627 "
The maximum power that could be required of the 70 motors on freight trains.....=2,219 H. P.
The average, ditto.....=1,078 "
Total horse-power possible....=3,486 "
Total power required from the generating dynamo.....=6,972 H. P.

COST OF MOTIVE POWER.

Six generating dynamos each about 1,162 H. P. at $29,000, inclusive of cost of motion....=$174,000.
Three steam engines and boilers each 2,324 H. P., at $58,000, inclusive of cost of machine..= 174,000.
Three power houses, at $10,000..= 30,000.
twenty-one motors for passenger trains, each 60 H. P., at $500..= 315,000.
Seventy motors for freight trains, each 32 H. P, at $800.....= 56,000.

Total cost of motive power.....=$465,500.

In this case the statement of cost of maintenance will be, taking the hour as the unit of time :

Interest and depreciation at 10 per cent .....=$ 5.31.
Coal for 3 engines, each 1,137 H. P, at 2 lbs. per H. P., at $3 per ton .....= 10.23.
Wages at power stations.....= 6.50.
Twenty-eight attendants at $70 per diem.....= 2.92.

Total cost per hour. .....=$24.96.

My reason for assuming a lower rate of depreciation for electrical machinery is because of its superior durability due to the absence of reciprocating action, and its simplicity of construction.

If we eliminate grade resistance to traction for one-half the moving load the total power required will be reduced 35 per cent., the original cost of motive power about 33 per cent., and the cost of maintenance 22 per cent. Eliminating one-half the curve resistance would probably increase the reduction 5 per cent. for first cost of plant, and that of maintenance about 2 per cent.

COST OF CONSTRUCTION—ONE MILE OF SINGLE TRACK ROAD—STEAM RAILWAY.

Total cost taken at about, not including shops, stations, motive power, etc.....=$33,000.
The grading would cost, say about= 10,000.
" small bridge work would cost, say about.....= 1,000.

$11,000.

ELECTRICAL RAILWAY.

Grading (reduced 50 per cent.)..=$5,000.
Bridgework (small, reduced 20 per cent.).....= 800.

$5,800.

Total cost (electricity.).....=$27,200,
Reduction.....=over 17 per cent.

The above figures point to but one conclusion and that is that the cost of maintenance of an electric railway is greatly under that of a steam railway.

There is no doubt but that there is large consumption of energy of the current by the attractive action between the wheels of the motor and the rails, simply from the fact that there cannot be a performance of work without it, but, taking that into consideration, the electric road will still retain a gain in point of economy of maintenance of not less than 40 per cent., although we find an expert railroad engineer placing it in a special case at 66 per cent.

An electric railway can be built for a cost not to exceed that of a steam road of like capacity and operated 40 per cent. cheaper. It can at the same time be lighted and heated by electricity, and communication can always be had with trains between stations. It is, by all odds, the cheaper, more safe, and better mode of propulsion.

To measure an electric current, the cathode is a platinum cup, and the anode a silver leaf enclosed in filtering paper. The anode is immersed in a solution of nitrate of silver contained in the cup; and an ampere deposits 4 grammes (62 troy grains) of silver per hour. it therefore suffices to allow the current to pass through the voltmeter for half an hour, or an hour, in order to obtain a deposit of silver, which may be weighed correctly by an analytical chemist's balance.

The contract for supplying the steam engines and boilers for the Edison Electric Light Company, of Harrisburg, Pa., has been awarded to the Harrisburg Foundry and Machine Co., of that city. They will supply Ide engines, and use four steel tubular boilers, 6′×16″. These will be set with the Jarvis patent furnace, and use Sheffield grate bars, so to burn coal screenings for fuel.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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What an enormous and intricate job it is to set up a multiple switch-board for two thousand subscribers can only be understood by those who have seen the process going on. In the Pearl street office of the New England Telephone Company in Boston, such a board was set up some weeks ago, and ever since the work of connecting the wires has been in progress. One would hardly believe what an immense number of wires is required. The only wonder is that so intricate a piece of work can be accomplished without error, and it is only by following a perfectly arranged system that it can be done. Comparatively few people really grasp the multiple board in its entirety, and those that do have whitened hair and a perpetual headache.

The Kansas City employes of the Missouri and Kansas Telephone Company gave a unique and successful entertainment in Merchants' Exchange Hall, January 22. A small telephone exchange was exhibited in operation, the telephones being placed around the room, the wires extending to a small switch board, which was connected with the main exchange by trunk lines, and operated by one of the regular operators. The dances were called by vibrating bells, the hall lighted by electric lights and numerous electric devices, including an electric girl, placed on exhibition. Extended notice was given the entertainment by the local press, and the linemen and operators complimented on its success.

The erratic course of the price of Bell Telephone stock, during the past ten days, seems to be due to "room-trading" and brokers combinations, rather than to any new facts or developments affecting the intrinic value of the stock. The fact seems to be that the amount of Bell Telephone stock actually dealt in is not large, the greater part being held for investment, and that it takes a comparatively small offering on the one hand or a small demand on the other to move the price up or down. Meantime it is safe for those who bought their stock at reasonable figures to hold it quietly, and let the market take its course.

CONCERNING "THE TIMES."

We have all been drilled into belief that there is a tide in the affairs of men which, taken at the flood, leads on to fortune. The trouble is to know when the time to take it has come. The man who knows how to measure his time accurately, and starts with the rising tide, is pretty sure to be landed out of the reach of storms and adversity. But if, unhappily, he mistake a roller in the falling tide for the beginning of the flood, he is battered about, thrown hither and thither, at the waves' mercy, and is fortunate if he escape with his life, without any consideration as to his possessions. If, on the other hand, he make the opposite mistake, and wait until the fact of the tide's turning has been doubly assured, he may be too late to profit by its full force, and may find himself still afloat and in deep water when the ebb comes again.

Let us consider "the times" in the light of this. Who were the ones that profited most by what is commonly called "the boom?" Was it those who realized early that the tide had turned, and, taking advantage of it, closed out at the top, or those who were late in finding out that things had taken an upward turn, and waited until they were well up before they ventured in. The question answers itself. Turn back to the files of the press for 1879, and you will find them full of the talk of hard times, and terrible predictions as to the future. Here and there, to be sure, some one thought he caught a glimpse of the dawning light, but he was set down as over-sanguine, and the drift of the general talk was in the direction of gloom. And yet it was in 1879 that the "boom" started, and it was those who stripped for it *then*, and plunged boldly into the tide that landed safe and sound "on velvet" before the crack of Guiteau's bullet exploded the boom, which had well nigh spent its force. The men who went in early in '80 did well, many of them, but those who put off their ventures until the winter of '80-'81 did their clamming at very high water, and those that have not been drowned are still struggling in what Cape Cod folks call "the drink."

We have no desire to tempt any one to do anything rash, or to give any advice as to when or how to start again, but it can do no harm to point to the fact that in this year of grace, 1885, things wear very much the same look that they wore in 1879, that the signs of recuperation are similar to those then made manifest, and that already, in a quiet way, men who have both money and brains are, under the stimulus of cheap labor, cheap material and cheap money are setting enterprises afoot in a quiet and unostentatious way, which they mean to have in proper condition for "unloading" upon an anxious, eager and sanguine public when the "snap" comes again. Men with money are just now quietly building railroads, of whose very existence the public is but little aware. Why? Not because they hope to run them at a profit in these times? No. Not because they hope to sell them now? No. But because, with material and labor at the present low rates, they can build and equip their road at a price per mile which would have seemed absurd five years ago. They are building their roads for hard cash, no bonds, no stocks, no nonsense. They are building them thoroughly and substantially, but economically. When the "snap" comes—and, sooner or later it is *sure* to come—those roads will be marketed at double or three times their cost. The builders, who got ready in time, and took the tide at its flood, will take the money, and the late comers, the ones who couldn't believe that good times were in sight until they were actually at hand, will get the property. Whether *they* make anything out of them will depend.

That the "boom" is coming again no sane man doubts. That the premonitory symptoms are now apparent to practised eyes may believe. That its coming cannot be very long deferred is next to certain. Why it comes need not be argued here. What we call great prosperity, which is but another name for great activity, comes like the tide, and, like the tide, it ebbs. It has its periods, somewhat irregular, it is true, but still reliable within certain limits. When it comes again all business will feel it, and none will be more affected than those based upon electrical inventions and discoveries. We look for the dawning of better times—nay, we believe that the dawn is upon us, a little faint, but still visible—and we trust that all who are engaged in electrical pursuits will keep a sharp lookout, ready to be in the very front rank when the right time comes.

THE ELECTRIC LIGHT CONVENTION.

A large number of letters at hand from persons widely scattered go to show that the attandance at the Convention of delegates representing companies engaged in electric lighting in Chicago on the 25th inst. is certain to be largely attended and full of interest. Now that the project has taken definite form, wonder is expressed that some such conference has not been held before, and each with whom we have spoken and from whom we have heard, has some new idea to suggest as to the benefits which may naturally be expected to arise from it. At the proper time we shall hope to bring these suggestions together, and submit them for the information of our readers.

Let us say once more, to avoid any misapprehensions, that the call for this convention expressly specifies that it is to be a convention of delegates representing companies doing an electric lighting business. It is called in the interest of *all* electric lighting, by whatever system, arc or incandescent. Its object is to enable men who are engaged in producing and providing electric lights, and whose business it is to deal with and overcome the many problems and difficulties which this comparatively new occupation presents, to confer and consult with one another, and, so far as may be, to benefit by one another's knowledge and experience. Exactly what the Convention will do, and just how it will do it, is for the Convention itself to determine. It is best that there should be just as little of the "cut and dried" element as possible. It is imperative that discussions as to the relative merits of different "systems" should find no place in its proceedings.

Electric light men are beginning to wake up to the fact that the "system" employed, say by a company furnishing an arc light, which is a most important factor, and perhaps the most important single factor in the problem of success, is by no means equal, in importance, to the aggregate of all the other factors. A good "system," electrically speaking, may be made to give very bad results with bad fuel, bad boilers, improper engines, and badly constructed lines, while a system admittedly inferior may, by using the best in all these directions, be made to give results very satisfactory.

Let us cite a case in point, carefully refraining from giving names, which do not at all concern the public, and if given, would add nothing to the force of the illustration. A gentleman informed us the other day that the lights in a certain city were exceptionally bad. He had seen lights in a great many places, but never had he seen them so bad as in this certain city, which we will call "X." "Now in ——," he continued, (we will call it "Y,") "the lights are first rate, burn steadily, and give plenty of light. One of them does more lighting than three of those in "X." The speaker was a person not in any way connected with electric lighting or any electrical business. He was simply a fair representative of an intelligent public. What he did not and does not know is the "system" in the two cities is precisely she same, and that it is one universally known and universally praised. The trouble is that in the two cities the handling is very different, and this we say with more assurance than may seem proper, because we have visited both cities and inspected both stations. The statement made by our informant is of course exaggerated. It is *not* true that one light in "Y" is as good as three in "X." But it *is* true that the lights in "Y" burn more steadily, more satisfactorily, and more economically than those in "X," and that while the company in the latter city is "scrubbing along," that in the former is doing a good business, keeps every light employed, and is making money. Now, we take it that "X" has something to learn from "Y," and we shall take the liberty of privately informing "X" of the fact.

A great deal of time will be saved, or, rather, a great deal more will be accomplished by the convention, if delegates who have views to express on any question which they think it desirable for the Convention to consider, will prepare themselves in advance by having all their data reduced to writing. What is wanted is exact information. A little thought before leaving home, a little consideration as to what information it will be well to have at hand, while the sources of that information are still within easy reach, will greatly facilitate the work and greatly increase the value of the convention. In closing we are glad to say that the Grand Pacific Hotel in Chicago will make reduced rates to gentlemen bringing credentials accrediting them as delegates to the Convention.

AN IMPORTANT ALLIANCE.

Information comes to us of a business alliance which is likely to have a very important influence on the future of the incandescent light, especially in New England. For several years there was a great deal of very foolish and senseless talk, in the press and out of it, concerning the relative merits of the incandescent and arc lights; foolish, because it was calculated to injure the prospects of both; and senseless, because to compare the incandescent and arc light is like comparing chalk and cheese—each is valuable, useful, and important in its place, but neither can, by any possibility, take the place or do the work of the other. It is to be added that of late there has been less of this sort of talk, the advocates of both systems having apparently come to their senses and realized that it is a waste of ammunition to fire at one who is in no true sense a rival, and who is in a position to be an important and useful ally. The files of this paper will show that the opinion has uniformly been held by us, and expressed over and over again, in season and out of season, that the two systems, instead of being in any way antagonistic to one another, could and should be mutually helpful and advantageous. The facts are just here: For the illumination of offices, dwellings, and spaces comparatively small, or even large spaces where the subdivision of the light is a matter of first importance, the incandescent light is, beyond all compare, the best, the safest, the most healthful, and in every possible way the most desirable light yet introduced. For exterior illumination, and for the general brilliant lighting of large interiors, where it is desirable to have the whole space filled

with a brilliant, soft, white light, the arc light is the only thing to be thought of for a moment. Gas is not to be mentioned in the same year with either, when applied to its proper use. It is heating, it vitiates the air, it gives off noxious gases which discolor fabrics and tarnish everything metallic, and deposits a fine soot which ruins clothing and furniture. It is dangerous—far more so than electricity—and its light is of a decidedly yellow tinge, perhaps the most trying of all colors to the eye.

Now if, when an arc-lighting company is established in a city, it opposes the introduction of the incandescent light, it is doing yeoman service for the gas company. It is brightening the streets, public halls, large stores, and in other places to such an extent that the average eye is keyed up to demand more light in the house, in the office, and in all places where the arc light cannot be made available; and the result is that two gas burners are put in operation where only one burned before, greatly to the emolument of the gas company, which, owing to this increased consumption, is enabled to continue business without a reduction of profits, despite the reduction in its prices which the advent of the electric light forced it to make. This is no fancy sketch. It is the actual experience in half a dozen cities that we could name, and it is literally true that the gas companies—some few of them admit it—owe the fact that they can continue to earn old-time dividends at greatly reduced prices for their product, to the increased demand growing mainly out of the stimulating effect of the electric light.

Now take the other view. Suppose an incandescent plant is established in a town, and comes into somewhat general use in offices and stores. It is far more brilliant than gas. To those who use it, the streets and all public places seem dark and gloomy, far more so than ever before. People who have not had the new illuminant introduced into their homes or places of business, find their abodes sombre, and in every direction more gas is used. The gas company, quick to see a coming demand, and rejoiced at its advent, begins putting mammoth burners into the streets, declaring that they are, if anything, more desirable and cheaper than arc lights—the exact reverse being the truth. And the local incandescent electric light company, by opposing the introduction of the arc light, gives to its real competitor, the gas company, exactly the aid and comfort which it most desires.

Taking this view of the case, it will not seem to our readers that we are using terms too strong when we say that the expressed antagonism and the apparent rivalry and competition between the two systems in even worse than foolish and senseless. On the other hand, it may seem that we speak with some undue warmth concerning the gas companies. We certainly speak with warmth, and we trust with indignation, but not with more of either than the occasion warrants. As the conductors of an established business which, despite the denials, was and *is* threatened by the electric light, save so far as gas can and will be used for other purposes than that of illumination, it was to be expected that they would use all just and proper means to keep their hold, and to maintain the field against all intruders, and, had they limited their course to these, no one could have found a word of fault. But what are the facts? They have steadily and persistently overstated and magnified the alleged dangers of the electric light; they have belittled its value as an illuminant, and have ridiculously magnified its cost. Their statements concerning it, as expressed verbally and by the recognized organs of the gas interest, have been almost uniformly false and misleading, and can have been dictated only by malice or ignorance, or, more likely, both. For these reasons, having in mind the interests of electric lighting *of all kinds*, and of those who have invested their money to secure its introduction, we ask no excuse for speaking with warmth, and certainly intend to speak with indignation.

We come now to the facts for which the above is a rather long preface. It is known that in nearly all the chief cities of New England the American Electric and Illuminating Company, have established arc lighting plants, which have been sold to local companies that are now operating them. It is also known that the New England Edison Company has put in several incandescent plants in cities in its territory, notably in Brockton and Fall River. Now, in every New England city in which the American Electric and Illuminating Company has established a plant, it has brought into association with itself some of the most prominent and progressive citizens. They see the value of the arc light, and they see the need of an incandescent light. They are to be got at certainly through the above named Company; hence it is that the Edison people in New England have approached this enterprising company with a proposition for an alliance which shall be mutually beneficial. Both sides recognize that there need be no rivalry—that there can be no real competition.

Our Albany correspondent says that Timothy Cornwell, Willard L. Candee and Robert J. Cummings, all residents of Brooklyn, are the incorporators and trustees of the Phelps Induction Telegraph Company of New York city, incorporated there on Saturday last. Capital stock, $2,000,000, divided into 25,000 shares of $100 each. Objects: the manufacture of instruments and apparatus to be used for telegraphing to and between railroad cars while in motion, and to and between railroad stations and railroad cars.

At the recent annual meeting of the Western Electric Company, in Chicago, last week, upon the resignation of Gen. Anson Stager, the president of that corporation, the following resolutions were passed:

Whereas, Gen. Anson Stager has this day resigned the presidency of the Western Electric Company, after thirteen years of unpaid and invaluable services in that office and as president of its predecessor; therefore be it

Resolved, That the directors of the company desire to hereby express to General Stager their appreciation of and gratitude for his services in the past and their best wishes for his future health, happiness and prosperity;

Resolved, That these resolutions be spread upon the record of the company, and that the secretary be instructed to transmit a fair copy thereof to General Stager.

The action of the stockholders of the Baltimore and Ohio Company in demanding an explanation of the right of the Baltimore and Ohio Company to divert its earnings to the building of telegraph lines was also considered a point in favor of Western Union. It has been claimed for months that the Baltimore and Ohio Company had no right under its charter to build telegraph lines all over the country, and rumors of a suit of inquiry have frequently been current. These rumors now seem to have crystallized into an active movement inspired by people who would rather have cash in the treasury than bonds of the Baltimore and Ohio Telegraph Company. Officers of Western Union say that sometime ago earnings decreased considerably, but have lately been improving and that the volume of business indicates a better condition of commercial affairs.

Report of Commissioner Butterworth for the Year 1884.

The annual report of the Commissioner of Patents for the year ended December 31, 1884, has been handed to the Secretary of the Interior. That part of the report which relates to the finances of the bureau shows that there was received during the year from all sources $1,075,799, and that there was expended $970,580—an excess of receipts over expenditures of $105,218.

The aggregate of receipts was made up as follows:

Fees for applications, $970,175; fees for copies of records or drawings, $65,331; fees for recording assignments, $24,004; subscription to *Official Gazette*, $11,846; fees for registration of libels, $3,943; total, $1,075,799.

The receipts for 1883 were somewhat larger, aggregating $1,146,240.

The items of expenditure during the year 1884 are set down as follows: Defense of suits, etc., $65; salaries, $557,359; *Official Gazette*, $34,521; photo-lithographing, $72,-991; copies of drawings, $2,611; scientific library, $5,200; transportation of publications to foreign Governments, $726; total, $673,483.

Amount expended by the Department of the Interior on account of Patent Office (for stationery, postage, printing and binding, furniture, repairs of office and contingent expenses), $297,097; total, $970,580.

The report shows that there is in the Treasury of the United States a balance on account of the Patent Fund of $2,781,695.

A summary of the work of the office for the year shows that there were issued 20,297 patents and designs; that 116 patents were reissued, and that 1,021 trade marks and 513 labels were registered; 12,301 patents expired during the year, and patents were withheld in 2,839 cases for nonpayment of the final fee.

Of the patents issued, 19,013 were to citizens of the United States and 1,284 to citizens of foreign countries.

The Commissioner again calls attention to the inadequacy of room and of facilities for conducting the business of the office, and to the unfitness of the rooms now occupied for occupation by human beings, and says that several deaths have already occurred from disease contracted in the foul, damp rooms. He also calls attention to the insufficiency of the facilities for conducting examinations, and recommends that an appropriation be made for a laboratory and such appliances and fixtures as are necessary. He asks that the force of examiners be largely increased, stating that the present force is inadequate.

In connection with this matter, he says "that those having business with the office have paid to the Government funds ample to provide everything essential to the prompt and proper dispatch of business, including increase of room, increase of force and additional facilities, is certain, and I respectfully submit that it would be difficult to find a satisfactory reason for withholding the fund from the use for which the Government received it, to wit, to pay the expense of a prompt and proper disposition of the business brought to the Patent Office;" and in reciting the evil results of the inadequate means at his command to further the business of the office, he says: "Many important interests are lost or greatly damaged by reason of the inability of inventors to have their applications disposed of within reasonable time."

The Commissioner recommends various increases of salaries of examiners in the office, and that the salary of the Assistant Commissioner be increased to $4,000 per annum.

No illuminant is safer than electricity, and none so dangerous as gas. The Pittsburgh people are very unfortunate in their experience with gas. First it was a single building that was blown up, quickly followed by two or three other explosions of a like nature. Then an idle iron mill became the scene of an explosion and a destructive fire from the same cause. The climax of disaster was capped yesterday in the blowing up of a whole group of buildings and the fatal burning of four or five of the inmates, while eighteen or twenty other persons received injuries more or less serious.

In view of these quickly recurring disasters, arising from the use of natural gas, it is not at all to be wondered at that men band themselves together and talk of tearing up the danger-breeding pipes. When men can neither ride in the street cars, sit in their own houses or take a glass of beer in a neighboring saloon without imminent danger of being blown into another world without the least warning, the temptation to employ violent measures becomes very great. Those who don't use the gas seem to be in as great, if not greater, danger than those who do, and the peril has thus become a general one.

Luther G. Tillotson.

Luther G. Tillotson, a prominent merchant, died in his residence, No. 19 East Forty-ninth street, at 8:30 Saturday morning last. He was born in Ithaca, N. Y., March 1, 1834, and received there an English education. When about fifteen years old he went West with his father, the late Daniel T. Tillotson, a constructor of telegraph lines, where he learned telegraphy. After a year he returned East and entered the telegraph service of the Erie Railway Company, of which when 19 years old, he became superintendent. In this position he remained several years, adding to his duties those of a division superintendent of the Western Union Telegraph Company. Early in 1862 he began business in this city as a merchant in railway and telegraph supplies. The house wask nown as Tillotson & Co.

On November 1, 1865, Mr. Tillotson, with Gen. E. S. Greeley and Mr. W. H. Holt, founded the present house of L. G. Tillotson & Co. During the past twenty years Mr. Tillotson has been associated with all the most eminent men in railway and telegraph construction. His opinions were almost universally sought in enterprises of this character, and his co-operation very frequently solicited with offers of positions of trust and honor, which he generally declined because they would distract his attention from his main object—a successful mercantile career.

The Telephone Suits.

The following is, we understand, the position of the various telephone matters in court at present: The Minister of Agriculture has rendered his decision in the case of the Bell patent, but his right to try the case has been disputed by the Bell Telephone Company, and this question has yet to be settled by the Court of Appeal. The other suits brought by the Bell Telephone Company are now in progress in the Court of Chancery, and are against the Dominion Telephone Company of Montreal, the Toronto Telephone Manufacturing Company, the Port Arthur Telephone Company (and some of the subscribers to its exchange), etc., and are for infringements of the Blake and Edison patents on transmitters, and the Phelps and Anders patents on telephone receivers, as well as the Bell. It is expected that some of these cases will come up for trial in Toronto shortly. The most important of these, so far as public rights are concerned, is that regarding the constitutionality of the powers devolved by Parliament, through the Patent Act, on the Minister of Agriculture, leaving his decision *without appeal*.

In the remainder, where large personal interests alone are involved, the law will take its course in the ordinary way—a practice from which there should be no deviation in any country where even the pretence of maintaining the rights of the citizens are ostensibly preserved. Anything outside of this is the merest mockery both of Law and justice.—*The Shareholder and Insurance Gazette—Montreal.*

It has been remarked that it must somewhat interfere with the plan of appropriating two cables for work at 10 cents per word, to break up the Mackay-Bennett opposition, when four cables of the combination companies are at this time useless. The Anglo-American line is the only one working belonging to the combination. The two Gould cables were broken weeks ago, and all attempts to repair them have proved fruitless. Two weeks ago the French cable was broken, and last week the Direct cable was reported broken. At this rate the Western Union's revenues from cable service will make a big showing on the wrong side of the ledger, which is an additional reason for advancing the price of the stock. The reduction of tolls to 40 cents per word has been enough to seriously hurt the companies. Saturday's cable dispatches from London stated that the report made to the stockholders of the Anglo-American Cable Company estimates that the total loss to the pool cables, because of the present reduction in tolls, will amount to $850,000 per annum. Another 10 cents off will double up the loss.

Telephonic News

*** Charles Hubert, manager of the Erie Company's telephone exchange at Lampasas, Texas, has disappeared. Examination of the books developed the fact that he had taken from $1,500 to $2,000 with him.

*** Our correspondent says that Evansville, Indiana, is to be congratulated upon having such an admirably conducted and efficiently managed institution as the telephone exchange of that city. The manager, Mr. Craig, is thoroughly experienced in every detail of the business, and is giving our citizens a service equal to that of any city in the country.

*** Mr. Edward J. Hall, Jr., formerly General Manager of the Bell Telephone Company, of Buffalo, has just been offered the management of the Long Distance Department, which was recently formed by the American Bell Telephone Company, and we learn as we go to press that he has accepted the charge of it. Mr. Hall's abilities are well known in this field, and comment is therefore unnecessary.

*** The Vienna telephone people have a practical way of putting up their wires, using neither poles nor house-tops, and yet not going under ground. There are affixed to the walls of the houses, on either side of the street, small and very neat iron frames, holding from eight to sixteen porcelain insulators. The wires are then strung along the fronts of the buildings on these insulators, between the second and third-story windows. The whole presents a very neat and even pretty appearance, the wires being inconspicuous on account of their smallness.

*** A young man named Richards, employed in the Bell telephone shops in Boston, Mass., has invented an improvement which promises to be of service in the telephone business. It is known as the Richards head telephone, and consists of a small telephone attached to two steel bands forming a segment of a circle. By means of a set screw, the shape and length of these bands can be altered and made to fit the operator's head, one band passing over the top of the head and the other around the back. The telephone is by this means held continually to the ear. The connection to the line wire is made by a flexible wire cord, and the telephone and attachments weigh but eight ounces. By using this arrangement, the operator in telephone exchanges is free to use both hands and sit in any position, a great improvement over the old style, where the telephone was attached to an upright standard on the operating desk.

*** The Canadian Bell Telephone Company still hold the field in Canada. The Edison and Blake patents still hold good, and the Canadian company is now only upon the same footing as the English Telephone Company where the Bell patent has been invalidated, but the Edison and Blake patents enable the company to hold the field. The output of telephones by the American Bell Telephone Company for the month ending January 20, 1885, was 2,186, but as the telephones returned amounted to 2,484, there was a net loss of 298 telephones for the month, against a net gain of 379 telephones in the previous month. The gross output in the month ending January 20, 1884, was 3,164, and the "returns" 1,052, making the net output in the corresponding month last year 2,112.

*** Mr. Hopkins, from the House Committee on Public Buildings and Grounds at Washington, to which was referred a petition to consider the question of the extension of underground telegraph and telephone wire to all the departments in Washington, has prepared a favorable report. The report says that the Committee has investigated the statements set forth in the petition and having become satisfied that the interest of the Government will be greatly subserved thereby, they recommend the extension of the system of underground wires, as proposed, and recommend an appropriation of a sum sufficient to defray the expenses and to pay for the work already done. "It appears," the report says, "that in October, 1883, the cable company located an experimental line between the Capitol, the Executive Mansion and War Department. These wires have been in constant use, giving tolerably good service. The system adopted, we believe, is that put down by the Callender Company of New York.

Kansas City News.

KANSAS CITY, Jan. 29.—The stockholders of the Missouri & Kansas and United Telephone Companies held their annual meeting at the office of Secretary Crandall, in this city, yesterday. The president, Mr. George L. Phillips, presented the following statements of the business of the two companies :

MISSOURI AND KANSAS TELEPHONE COMPANY.

"*To the Stockholders:*—From the report and trial balance of the treasurer of our company, I take the following figures for your information :

On the first of January, 1884, we had	2,007 subscribers.
On the 31st of December, 1884, we had	2,559 subscribers.
Making an increase of	552 subscribers.

Or about twenty-six per cent.

"Our net earnings for the year 1883, were $28,604.83 ; for the year 1884 they were $47,741.40,—being an increase of $19,136.57, or about sixty-six per cent.

Our debt on January 1st, 1884, was	$24,750.11.
Our debt on December 31st, 1884, was	33,922.61.
Being an increase of	9,172.50.

"We have had, therefore, net earnings amounting to $47,751.40, and the increase in the debt of $9,172.50 to dispose of, which has been done as follows :

Construction	$48,183.47.
Bells, Merchandise and Personal property	6,497.09.
Bills Receivable	1,943.00.
Cash on hand	320.34
Total	$57,913.90

"Of the amount expended on construction, $3,992.10 was spent at Atchison ; $32,321.81 at Kansas City ; $2,169.94 at Leavenworth ; $1,999.92 at St. Joseph ; $832.98 at Topeka, and the balance has been used at other points in the territory. We have increased our mileage of toll lines, 75 miles. The exchange at Mexico was closed on the 31st of December ; being the only one closed during the year. The greater part of our growth has been on the Kansas City Exchange, which has, as you will see, received the greater part of construction. I believe these figures will show the Missouri and Kansas Telephone Company has been unequaled in its growth by any company in the United States, during the past year, and that the present year will see us entirely out of debt and able to resume dividends. The bonds which you authorized in January, on account of the unfavorable condition of the money market, have not been disposed of, and have therefore been canceled and destroyed, so that the sum named gives the entire indebtedness of the company. I desire to express my obligation to the officers and employees of the company for their earnest work during the past year."

UNITED TELEPHONE COMPANY.

"*To the Stockholders:*—I herewith submit some figures taken from the treasurer's trial balance and statement for the year ; also some figures based on the business of last year, and making comparisons between the two, for the purpose of acquainting you with the present condition and position of your company. In showing the increase of net earnings for the year 1884 over 1883, you will please bear in mind that as the company was organized March 1st, 1883, we have been obliged to take the figures for the last six months of 1883, and double them, to make our estimate for the whole year.

On the first of January, 1884, we had	1,192 subscribers.
On the 31st of December, 1884, we had	1,319 subscribers.
Being an increase of	127 subscribers.

Or over ten per cent.

Our net earnings for the year 1883 were	$7,288.00.
Our net earnings for the year 1884 were	9,231 81.
Being an increase of	1,943.81.

Or over twenty-six per cent.

Our debt on the 1st of January, 1884, was	$12,698.45.
On the 31st of December, 1884, it was	17,922.95.
Being an increase of	5,224.50.

You will thus see we have expended this year the net profits $9,231.81 with the increase in our debt of $5,224.50, which makes $14,456.31, which has been disposed of as follows :

Increase in cash on hand	$ 865.81.
Increase merchandise, bells and personal property	2,958.71.
Construction	10,631.79.
Total	$14,456.31.

Of our construction account, we have spent at the Burlington, Kansas, exchange, $1,508.81 ; at the Winfield exchange, $820.60 ; at the Lawrence exchange, $2,341,86 ; and the balance has been spent in smaller amounts throughout the territory. We have increased the mileage of our toll lines by thirty-one miles. On account of poor business we closed the Burlingame, Kansas, exchange on the fifteenth of May, and the Osage City, Kansas, exchange on the the thirty-first of December. I regret that we cannot show a more handsome increase in our business during the past year, but as the exchanges of this company are mostly in towns of less than four thousand population, they have been the ones to first and most seriously feel the business depression which has prevailed during the past year, and it has been only by the greatest difficulty that they could be sustained. When general business revives sufficiently to allow us to obtain the necessary funds to construct lines to connect most of our exchanges, we will be able to place our business on a much firmer foundation. It has been impossible to dispose of the bonds authorized in the early part of the year without a sacrifice which I did not deem justifiable. They have therefore been canceled and destroyed ; so that the entire indebtedness of the company is as given above. On account of the consolidation of the offices of this company with those of the Missouri and Kansas Telephone Company, our expenses are somewhat less than they would otherwise be. I think that during the coming year the general superintendent can dispense with the services of one assistant"

The election of directors for the two companies resulted as follows : Geo. L. Phillips, Dayton, Ohio ; J. A. Chick, and C. D. Crandall, Kansas City ; J. T. Lane, Davenport, Ia., J. R. Mulvane, Topeka ; W. B. Clarke, Junction City ; J. A. Corby, St. Joseph ; Theo. N. Vail, and E. T. Gilliland, Boston. Mr. Phillips, positively declining a re-election Mr. Jno. R Mulvane, formerly vice-president, and a gentleman well adapted for the responsibilities of the position, was unanimously selected as president of both companies. Mr. C. D. Crandall was unanimously re-elected secretary and treasurer.

BI-POLAR.

*** All the telephone wires on Staten Island were cut on Friday night. A few days ago the salaries of the employees of the company were all largely reduced, when the superintendent and other employees resigned. The perpetrators of the mischief are unknown. Some of the old linemen were adjusting the wires on Saturday. The cutting was done in several places and the ends of the wires tied together.

Spreading the Wires from the New Orleans Office in All Directions — The Suburban Service.

The company originally organized to do a telephone business in New Orleans was the Louisiana Telephone Company, owned and controlled by local interests. The property of this company was afterwards acquired by the Great Southern Telephone and Telegraph Company, the transfer being made in July, 1883.

Immediately after the new company took possession of the property, they began the work of reconstructing the entire system. Under the management of Mr. E. T. Baker and Mr. J. J. Fowler, the work of improvement has been continued, and it is the intention of the company to make the system in New Orleans second to none in the country.

When it was decided to move the distributing office of the company from its former location in the Denegre Building, on Carondelet Street, to the present location, at the corner of Poydras Street, an entire outfit of equipments, including all the modern improvements, was ordered. This equipment was ordered from the factory in September, 1883, but in placing it in operation it developed many imperfections. But desiring to have the system as perfect as the latest modern ideas would permit, the controllers of the company at once ordered a new equipment for the office, which was received and completed about the 1st of December, when the transfer to the new headquarters was effected

The service has been quite costly, necessitating the employment of from 50 to 150 persons to carry it on. The force is now very large owing to the necessity of meeting the requirements of the exposition.

Work on the out-of-town service is progressing rapidly, and, when completed as now projected, will cover a territory requiring 800 miles of wire. About 500 miles are now in process of construction. The line to Port Allen is about 150 miles long, and the Franklin line 140 miles. The length of these lines requires a wire of high conduction power, and to meet this requirement No. 14 hard-drawn copper wire is used.

The line to Baton Rouge is nearing completion, the linemen having reached a point about 15 miles south of Baton Rouge, and the poles being up to a point two miles north of Kennerville.

On the west bank of the river a line has been in operation about a year to Port Allen ; but, in order to meet the needs of the plantations, a second line will be strung on the poles to Edgard. A line is being constructed from St. James to Donaldsonville, and will be completed on Saturday next.

With the completion of this line the construction gangs will be transferred to the work of building a new line to Napoleonville, along the Bayou Lafourche, to Thibodaux and Terrebonne. From the latter point it is the intention of the company to build a line both ways, to connect the city and intermediate points with a terminus at Franklin.

Material has been distributed for the construction of lines with terminals at Shell Beach and Pointe-a-la-Hache with intermediate facilities for connecting with the plantations. One gang is now at work on the line from Pointe-a-la-Hache to Poydras Plantation. The material and poles are now on board the cars here for the construction of a line from Algiers to Gov. Warmoth's plantation, on the west bank of the river.

The system outside of the city is operated under a different franchise and upon a somewhat different system. Instead of having a telephone at so much per year, a telephone is placed on the guarantee of $100 worth of business in a year. The person securing the telephone makes a deposit of $100, and is furnished coupon tickets of that amount, the basis of the service being a charge of 15 cents for five minutes' conversation.

The city service now covers 1,148 exchange contracts, representing 1,200 exchange leases, this discrepancy between the two figures being accounted for in the fact that a number of firms or individuals have in use more than one telephone on one wire. The system is constantly increasing, and, in order to meet the expected immediate wants, the order has been given to increase the distributing service in the city from 1,200 to 1,350 telephones.

Canadian Telegraphy.

In our last issue we sounded "a note of warning" to the shareholders in the Montreal and the Dominion Telegraph Companies. On that occasion we reiterated the demands of the public that the Government should assume possession of the entire system of telegraphy throughout Canada—either by purchase, or by erecting their own lines. We now place before our readers a rough estimate of cost and revenue. Also, our reasons for urging upon our rulers such desirable consummation without any further avoidable delay. The Montreal and the Dominion Telegraph Companies combined represent about 17,500 miles of poles, and about 30,000 miles of wire (many hundreds of miles of now superfluous poles having been duplicated during the former competition between those corporations, and two or more wires having been placed upon poles through certain districts). About 3,000,000 messages per annum are transmitted over the Companies' lines, yielding a gross revenue of probably $1,000,000 per annum. At all events we know that their business and net revenue enable the Great Northwestern (*alias* Western Union Telegraph Company), as lessees, to pay them annual dividends of—

8 per cent. upon $2,000,000.....	$160,000
6 " " " $1,000,000 plus $280,000 bonds.	77,520
Or a total of....	$237,520

plus middleman's profit to the Great Northwestern Telegraph Company, and the "consideration" which the Western Union Telegraph Company doubtless collects for risk of guaranteed dividends to the amalgamated Canadian shareholders. In all, the net revenue in Canada cannot fall short of $300,000 per annum. Now we desire to impress upon the public mind the most important fact that less than one-half of such revenue would enable our Government to pay 4 per cent. interest upon the market value of the paid-up capital stock of the Montreal, Dominion, and Great Northwestern Telegraph Companies, including the cost of purchasing or duplicating the Western Union land lines throughout the Provinces of Nova Scotia and New Brunswick. It is very evident that 4 per cent. Government debentures are vastly preferable, as a permanent investment, to the precarious guaranteed dividends of 8 per cent. and 6 per cent. by a company which must henceforth compete with a powerful organization now established upon its hitherto monopolized soil, and struggle against the impending shortage of receipts from the Montreal and Dominion Companies' lines upon the termination of the monopoly they at present enjoy. Commencing with a sliding-scale of say fifteen cents for ten-word messages between points 1,000 miles distant, twenty cents for under 2,000 miles, and twenty-five cents for distances exceeding 2,000 miles, and taking into consideration the consequent increase of business accruing under such reduced rates, it is safe to state that the net revenue would exceed $200,000 per annum. This sum would be sufficient to meet the interest upon debentures to be issued in payment of the companies' lines, plus interest upon cost of the Gulf of St. Lawrence and North-West Province lines, which have been erected by the Government for humanitarian and colonization purposes. And we may here remark that we fail to understand the justice or policy of subsidizing alien corporations with the telegraphic earnings of remunerative districts and at the same time maintaining communication with and through the sparsely populated districts, which, while adding to the receipts of the former, remain an annual tax upon our Treasury.

Or, should our Government be necessitated, or deem it advisable, to erect their own lines, at a total cost of under $2,000,000 (a sum sufficient to duplicate all established stations throughout Canada), the net revenue derivable therefrom would still be more than sufficient to meet the 4 per cent. interest expended upon construction, despite the competition of existing companies.

Our reasons for again urging upon Government the assumption of Canadian telegraphy without further avoidable delay are briefly as follows:

1st. That 4 per cent. interest-bearing debentures to the amount of between $3,500,000 and $4,000,000 would to-day purchase existing lines, recoup the Great Northwestern Company for its legitimate expenditure, and purchase or duplicate the Western Union land lines throughout Nova Scotia and New Brunswick. But if delayed until the Canadian Pacific Railway Company has established its commercial (as distinct from its railway) telegraph wires, or another company (probably in connection with the Baltimore and Ohio United States lines and their trans-Atlantic cable connections) constructs competing lines throughout Canada, a very much larger sum, amounting to several millions, would afterwards be required for the purchase of then existing lines.

2d That during such competition the struggling desire of the Montreal and Dominion Companies to earn a dividend upon their respective lines would so curtail outlay for repairs and renewals that their property would greatly deteriorate in value.

In conclusion we may add that we utterly disbelieve the statement sometimes hazarded that the telegraph in the hands of the Government would become a special field for political patronage and corruption. Such has not been the result in England or foreign countries. We fail to see, indeed, why a similar reflection should not be made upon our postal system, with which the telegraph service would be affiliated; and why we should not urge upon our Government the now generally expressed wish of our people that they should assume the entire control and management of Canadian telegraphy throughout the Dominion of Canada.—*The Shareholder, Montreal.*

A Bill Filed to Determine the Relations of the Railroad Company to the Telegraph Company—Forty-eight Answers Wanted—Both Sides.

Papers were served on Saturday, January 31, upon the officials of the Baltimore and Ohio Railroad Company by a shareholder in that corporation, for the purpose of discovering the relations that exist between the Baltimore and Ohio Railroad Company and the Baltimore and Ohio Telegraph Company, the amount of money which has been expended on the latter, the authority for the same, and to inquire what losses or profits have been incurred or realized by the railroad company or its officers. The plaintiff in the case is Mr. W. Octavius Ross, of Orange, N. J., who, on behalf of himself and as many others as will join him, takes these proceedings in the United States Court. The bill of complaint is very ample, and sets forth in full detail the powers possessed by the railroad company, which the plaintiff avers do not include the power to advance large sums to outside corporations, such as the Baltimore and Ohio Telegraph Company. In order to reveal what the real facts of the case are, a series of forty or fifty questions are propounded for the railroad officials to answer. The attorneys for the plaintiff are Frederick W. Story, Francis P. Stevens, and Edward Otis Hinkley.

The bill avers that the act of Assembly of 1882, authorizing every railroad company in the State to construct and maintain telegraph lines, etc., did not contemplate the purchase, lease, or control of lines already constructed or to be constructed by others not railroad companies. Reciting the incorporation of the Baltimore and Ohio Telegraph Company, the bill calls attention to the fact that the capital stock named is only $5,000, while the annual report for 1884 names $2,012.000 as being expended in that year alone—an amount over four hundred times as great as the capital stock—and, says the bill: "Your orator is informed, and therefore charges and avers, that the president, directors, and other officers of the Baltimore and Ohio Railroad Company, or certain of them, together with other corporations and persons, have conspired together with the Baltimore and Ohio Telegraph Company and its officers, or certain of them, to defraud the stockholders of the Baltimore and Ohio Railroad Company, and to confuse the affairs of the two companies for their own private advantage and the advantage of the Baltimore and Ohio Telegraph Company, to the great loss, detriment and injury of the stockholders of the Baltimore and Ohio Railroad Company." The complainant propounds forty-eight interrogatories, which it is prayed the defendant may be required to answer, among them the following:

What is the amount of capital in stocks or bonds, issued and promised, or proposed to be issued?

What is the amount of indebtedness?

What is the amount of capital furnished by the railroad company, directly or indirectly?

What is the value of the plant, construction, etc.?

What are the losses, profits, if any? And if losses, how are they paid?

Was the undertaking, expenditure, etc., authorized by the Baltimore and Ohio Railroad Company? If so, in what form?

Concluding, the bill prays the court to require the Baltimore and Ohio Railroad Company to account for all moneys, credits, or property in any manner loaned or advanced to the telegraph company, and that all such moneys, credits, funds, or property be ordered and decreed to be refunded, and that the Baltimore and Ohio Railroad Company be strictly enjoined and prohibited from loaning or advancing any further sums, credits, etc., to the telegraph company, or from taking any promissory notes, stocks, bonds or other securities, issued or to be issued by the telegraph company, and that the Baltimore and Ohio Railroad Company be enjoined and prohibited from taking or accepting or investing in notes, stocks, bonds, etc., of any and every other corporation doing business under the name of the Baltimore and Ohio Telegraph Company, The bill is sworn to before Henry P. Butler United States Commissioner for the southern district of New York.

.... Mr. Jay Gould said to a reporter recently: "Do I look like a sick man? I am sound in mind and limb. I have telephone and telegraph connection with my office, and it makes little difference whether I am here or down town. I look for improvement in prices. Business is picking up all over the country, and we shall soon begin to see that people are making money. The balance of trade with England is in our favor. A great deal of exchange is held on this side—fully $30,000,000—most of it borrowed. Sooner or later it will bring gold. The reactions we are having in the market do not amount to much. Bears lose stock every time they sell. The short interest is large, and in some stocks is enormous. The street does not realize how large is the short interest in Western Union's. Nearly every one I talk to is a bear on the property. The size of the short interest does not show in the loaning rate, because everybody who has the stock is lending it. There are about 100,000 shares of Western Union loaned in the street to-day. There is a large short interest in Union Pacific."

.... Statements were made yesterday that the Baltimore and Ohio and the Bankers and Merchants' Telegraph companies contemplated forming a new pooling arrangement. Up to September a pool existed among the Bankers and Merchants', the Baltimore and Ohio and the Postal Telegraph companies. The Baltimore and Ohio withdrew from this because the results were not as profitable to that company as was at first expected. The Bankers and Merchants' and the Postal Telegraph Company did not maintain the pool very long after the Baltimore and Ohio withdrew. The rumor yesterday was that the Bankers and Merchants' and the Baltimore and Ohio intend to renew their pool upon a basis which will be profitable to both sides. No official confirmation of the story has been received at any of the offices, but a gentleman in the Baltimore and Ohio Company said the statement seemed probable.

TELEGRAPHIC

.... An English writer says that America has no leisurely class. This writer evidently never saw an American telegraph messenger boy performing an errand.—*Boston Courier.*

.... The Bell Telephone Company of Canada, have not, by any means, given up the fight for their exclusive rights in Canada, to which they are entitled under the Edison, Phelps, Blake and Andrews patents. They have proceeded in the Court of Chancery against the Toronto infringers.

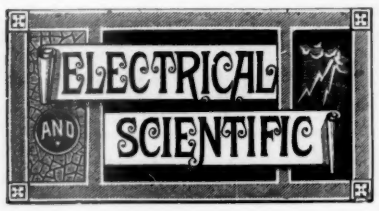
... A. A. Lochrane has filed a bill in the United States Court, at Atlanta, Ga., asking for a receiver for the Southern Telegraph Company. He holds $30,000 worth of the bonds of the company, on which $900 interest is due and unpaid. The case was set down for a hearing on March 2.

.... R. D. Yancey has been appointed by the Circuit Court of this district receiver for the Southern Telegraph Company for the section comprising Lynchburg, Danville and intermediate points. This is supposed here to be a flank movement by the Bankers and Merchants' Company against General Mahone and others, who threw the Southern Telegraph Company into the hands of receivers in the Norfolk courts a few weeks ago.

.... The latest reduction in telegraph rates is announced by the Baltimore & Ohio. The company will make no charge for the dates in messages to and from Central and South American points, via Galveston and Texas. This reduction to Mexican cities for ten words is from 50 cents to $1. The Commercial Cable Company will not hereafter charge for dates to and from London—a concession the business public has been trying to secure for years.

.... A bill is now pending before the legislature "to incorporate the Dirigo Telegraph Company, to construct at once lines to all the principal points in Maine to connect with the Baltimore and Ohio Telegraph Company." The corporators named in the bill are Frank Jones, of New Hampshire; Payson Tucker, George P. Wescott and Charles P. Mattocks, of Portland; J. R. Bodwell, of Hallowell; Frederic Robie, of Gorham; F. H. Clergue, of Bangor; George C. Wing, of Auburn; William H. Bigelow, and H. S. Osgood, of Augusta. A hearing will be had on this bill next week before the Committee on Railroads, Telegraphs and Expresses.

.... The French Government have at last sanctioned the laying of a submarine cable from Zanzibar to Reunion, thus connecting that dependency with the mother country by way of the Eastern Telegraph Company's cables to Aden, Alexandria, and Marseilles. Our own dependency, Mauritius, will also profit by the new enterprise, as the cable will land at that island. The route is by Mayotte, Nossi Bé, St. Mary's, and Tamatave, in Madagascar. The heliograph between Reunion and Mauritius will thus be rendered unnecessary, as far as the telegraphing of cyclones is concerned, at least so long as the cable is in working order; but it might be advisable to maintain the heliographic stations in case of mishap to the wire. Another important cable will be laid by the steamship Kangaroo of the Telegraph Construction and Maintenance Company, to Lloyd's signal station on the Fastnet Rock. The submergence of this cable, and that to the "Sunk" lightship, show a welcome awakening to the value of such means of correspondence, a point on which, notwithstanding our vast maritime interests, we are behind such countries as Norway, and even some of our own colonies, for example, Canada. The steamship Silvertown has also been recently engaged in cable work on the west coast of Africa. When Capetown is connected to Senegal, and Montevideo or Rio de Janeiro, the cable system of the world will be tolerably complete, always excepting that long trans-Pacific line, from San Francisco to Japan, which has often been projected, but never yet realized.



* * The quinquennial prize of the Belgian Government has been awarded to Prof. La Paice, of the University of Leige, for his researches in mathematics and physics.

* * The *Wiener Elektrotechnischen Zeitschrift* says that the Scientific Examining Committee of the late Vienna Electrical Exhibition talks of the application of static electricity to medical purposes; but the *Centralblatt fur Elektrotechnik* asks how *static* electricity can be *applied* at all.

* * For some time past, the question has been under consideration of adding a course of lectures on electricity to the instruction given at the Ecole Central des Arts et Manufactures. Among the electricians capable of filling the new chair of electricity, the names have been mentioned of M. Hospitalier, Professor at the Ecole Municipale de Physique et de Chimie ; M. Monnier, laboratory directory director of the Association pour l'etude de l'Electricite : and M Geraldy, late Ingenieur des ponts et Chaussees.

* * M. Jablochkoff announces another battery of great scientific interest. A small rod of sodium weighing about 8 grammes is squeezed into contact with an amalgamated copper wire and flattened. It is wrapped in tissue paper and then damped with three wooden pegs against a plate of very porous carbon. This completes the element. The moisture of the air settles on the oxidized surface of the sodium. It works without any other liquid. The E.M.F. is 2.5 volts, but the resistance is as great as 25 ohms.

* * The national debt, less cash in the Treasury, was increased, instead of diminished, during December to the extent of $641,000. The increase in the debt in November was even more than this and the reduction in the national debt for the six months of the fiscal year is only $32,143,000. There is not going to be the usual hundred million reduction in the debt by next June, nor is there any need of it. A reduction of $15,000,000 every six months from now until September, 1891, will just extinguish the bonds now subject to call by the time the $250,000,000 four and a half per cents become subject to redemption.

* * The statement of the foreign commerce of the United States for December contains two very remarkable features One is a trade balance in our favor of forty-nine and one-quarter millions, a balance but once exceeded in the commercial history of the country, and the other imports of gold amounting to only $1,815,331 net. Concerning the small influx of gold and the maintenance of rates of foreign exchange it is said that the favorable balance of forty-nine and a quarter millions in December was preceded by one of thirty-three and one-half millions in November, and one of nineteen and one-fourth millions in October, making together a total of no less than 102 millions in three months.

* * Carbons for arc lights may be made, says a well informed writer, by thoroughly incorporating a mixture of finely divided carbonaceous materials, such as the purer forms of coke, or gas retort carbon, with some liquid substance, such as oil, tar, or sugar syrup, that, when subjected to a high temperature, is capable of being carbonized. The finely divided ingredients are thoroughly mixed and made into a stiff paste with the carbonizable liquid, and then forced by heavy hydraulic pressure through circular apertures in plates. The continuous cylindrical rods thus obtained are cut into suitable lengths, carefully dried, and then heated to incandescence in ovens while out of contact with air. By this process the carbonizable liquids are reduced to a carbon, which thoroughly binds together the various ingredients. Experience has shown that the higher the temperature and the greater the length of time during which the carbons are subjected to the baking process, the greater their hardness and the higher their electrical conductivity. In order to insure freedom from slight porosity, in most cases the carbons are subjected to a re-baki g. After removal from the oven they are soaked in strong syrup, and again placed in the oven and heated to incandesence as before.

* * In the environs of Kairwan, the holy city, there is a keeper of kouba or shrine, who has introduced the telephone, or is about to do so, into the exercises of his functions in a singular and unexpected manner. To understand the story, it must be explained that this keeper is of French origin—belonging to a good Norman family of Rouen, I believe—and the son of a Minister of State under the monarchy. He is 50 years of age, and has passed through the most curious experiences. He was once n priest of the Premonstrants, whose principal monastery is near Avignon, and known as the Couvent de Frigolet. It will be remembered that, on the execution of the anti-clerical decrees, Gen. Billot was obliged to lay siege to this monastery, and the clericals revenged themselves on him by nicknaming him "Duc de Frigolet." Our keeper of the kouba, after leaving the Frigolet Monastery, became a Trappist at the Abbey of Staonelli, in Algeria. After a time he left the abbey and proceeded to Tunis, where he turned Mussulman, and settled at Kairwan, where he lived until the entry of the French into Tunis. He rendered at the time some service to his native country, and was invested with the charge of a kouba, slightly owing. I believe, to French influence. He speaks Arabic admirably, preaches on the Koran with great unction, and enjoys renown for his wisdom among the Arabs. The very intelligent French Minister Resident, M. Cambon, has probably not neglected to cultivate him and take advantage of his influence in the interests of his country. However, for the present, the keeper of the kouba lives on the offerings of the believers who visit the shrine. The revenues from such a source are necessarily small, and it has occured to the ingenious Frenchman that a telephone might render him real service. As the Arab pilgrims come to consult the saint, the keeper is about to install a telephone in the kouba, which will convey to him in his chamber the questions put to the saint aud return his own replies. Besides the material advantages which this mode of performing his ministry might bring him, he knows that he would produce a deep and salutary impression on the minds of the faithful, for whom the modus operandi would long remain a dread mystery. This is an instance of how inventions often produce results, and are adapted to purposes which their inventors little dream of. How easily might one find an explanation of many events at the dawn of history which were held to be supernatural or marvelous!

Evolution of the Electric Railway: Its Commercial and Scientific Aspect.

BY DR. W. ADAMS, MEMBER OF THE ENGINEERS' CLUB OF ST. LOUIS.

We must consider somethin g besides the mere propulsion of a car. Electricity possesses innumerable novel and superior qualities or features which have never heretofore been presented to the railway constructor, although fully appreciated by railway economists. It behoves us to grasp and make the most of these. To be sure, some kind of operation may be for a while attained at maximum outlay, in a primitive, impractical manner, but that which should be striven for is maximum economy as regards mechanical return, and such perfection in operation as will insure a minimum wear and tear. The application of electricity to railway propulsion means a complete revolution in railway construction and manipulation. In dealing with electricity as an agent of locomotion, it is unnecessary that we should adhere to those methods and processes which experience has demonstrated as essential to steam locomotion. On the contrary, having a totally different element to deal with, new problems are presented, and new principles involved. In handling the question of steam locomotion, Stephenson, after giving preference to the principle of traction over cables, concluded that it would be decidedly best to apply the power directly to each axle, or, better still, to each wheel of every car, and operate each car separately. Fnding such an arrangement impossible, however, he next decided upon making each car at least its own locomotive. But this system also proving impracticable with steam, he as a *dernier ressort*, adopted the "train system," with its ponderous locomotive. Had Stephenson and his followers found it as practicable with steam as we now find it with electricity to apply the power to direct each wheel, the long "train system" of locomotion would never have been instituted. One of the first requirements, therefore, of an electric railway system embodying the elements of permanency and commercial success, is the abolishment of the locomotive and its essential dead weight, which, in turn, does away with the "train system" and its numerous objectionable features. When a number of cars are coupled together their wear and tear and weight are necessarily greater. The impetus of a train being thus increased, it becomes more difficult to stop it, and the results of an accident are more disastrous both to life and property. The amount of air always carried between the cars of a train offers great resistance. All curves must be of higher degree than would otherwise be necessary, and a very much larger percentage of power is lost in making the curves than would be the case in a system applying the power to each wheel or axle. In the train system, if one car catches fire, or jumps the track, others are very likely to do the same, and thus again is the company's yearly expense greatly increased. The cars being individually heavier, and the necessity of providing for the weight of the aggregate number of cars massed together in the train system, increases the cost of the roadbed and all culverts and bridges. When we dispense with the locomotive and its attendant dead weight, we abolish the cost of the power consumed in propelling the same, and we greatly lessen the principal cause of wear and tear of the road-bed, culverts, bridges, &c., and, furthermore, we render possible the use of much lighter rails, and thus again further reduce both the first cost of construction, or the capital invested, and the cost of operation. Cars which are not being continually bumped together and wrenched to pieces by a heavy train, may certainly be built lighter. In the locomotive train system the weight which must be provided to supply a proper amount of adhesion between the rails and the wheels is a *dead* weight, requiring as much power for its propulsion as is required by the remainder of the train; in fact, nineteen tons of dead weight must be hauled for every ton of passengers carried. Furthermore, this necessary dead weight is a fixed quantity, and does not vary with the actual paying load to be hauled. The adhesive power and its attendant dead weight to be propelled remain the same, whether the accompanying cars are but one-tenth filled or fully loaded, and railway statistics show that the average number of passengers carried by each train is but 70; whereas, in a system having the tractive power distributed, whether the cars be run singly or in trains, the weight which gives the adhesive power is more nearly proportionate to the load to be carried; and the weight which contributes this adhesive power is not a dead weight, but one that the operators of the road receive pay for. As each passenger enters a car, an additional weight is supplied for the exertion of just as much extra traction between the rails and the wheels as is required to propel such an increase in the load.

Here, then, we have an expenditure directly proportionate to the demand, the height of economy being thus attained. A no less important indication in railway propulsion looks to the application of the power *directly* to the point where it is to expend itself. Be this never so desirable, however, such a thing is impossible with steam, but in every way practicable with electricity—indeed, electricity seems here to have found its grandest and most important application. Again, an all-important indication for a successful electric railway may be said to lie in the fact that an electro-dynamic machine, when operating with greatest economy and safety, must, like a generator, run at a predetermined maximum speed. Hence, provision must be made for varying the speed of the car by some other means than by varying speed of the electric motor. Means must be provided for allowing the armature, or that portion of the electric motor which revolves at a high speed, to attain full headway independently before any load is placed upon it, and the latter should be applied gradually, in order to avoid jerks. In addition to the economy and safety insured by this arrangement, we, in starting, allow advantage to be taken of the impetus of the motor in overcoming the inertia of a car, and, furthermore, we do not compel the motor to do its work rapidly, since it is a *sine qua non* of an electric motor that it shall do its work slowly. Thus, it will be possible for an electric car to obtain maximum speed almost at the start, whereas from an eighth to a half mile is required for a steam engine to acquire its running speed. This one point alone renders electricity, when properly applied, particularly suitable for city surface and elevated roads, where frequent stops are necessary.

It must also be possible to vary the quantity of electricity running through the car, or rather of varying the quantity tapped from the main supply, without introducing useless resistance. There must, furthermore, exist at the central or generating station an automatic regulator, or equivalent arrangement, which will keep the supply of electricity in the mains always proportionate to the demand, and which shall regulate the amount of fuel consumed in the steam engine so that it, likewise, will be proportionate to the power or electric energy absorbed throughout the system.

But little, if anything, has been done towards developing the electric railway outside of what Dr. Siemens did in 1879, namely, the simple mounting of an electro-motor upon a car and connecting this up by means of a leather or chain belt, or by a train of cogs, with the car axle. Siemens at first built an electric locomotive, but we notice he soon abandoned this principle and began mounting his machines on each car, and connecting these up with the axles by means of belts. Evidently his discerning mind soon grasped the situation, and he began applying the power in a way better calculated to develop the superior advantages of electricity.

Edison and field, however, have adhered to the locomotive principle and train system, as witness their exhibitions at Chicago and Louisville.

It certainly requires but little mechanical knowledge to appreciate the weak points about all these.

In the first place, either the cars must be mounted upon their axles rigidly without springs, or else the motor, which is mounted upon the car, and the axles with which the motor is geared will move differently and will not always be in line.

Second, no form of belting will do for a practical commercial railroad—that is simply out of the question, as every engineer must concede at once.

Third, gearing between parts which move differently, and are constantly getting out of line is also impractical.

But little has been done towards thorough insulation for the conductors, and in devising a practical moving contact.

Absolutely nothing has been suggested as a means of economic regulation, in every instance useless resistance being used, and the current wasted in useless heat.

To recapitulate: Among the many advantages of electricity properly applied as a motor over steam for passenger transport, is the circumstance that no heavy machinery or

fuel has to be carried about to set the train in motion. The carriages running singly may be built much lighter, thus reducing the power necessary to move them, reducing the noises made in running, greatly lessening the wear and tear of both tramway and rolling stock, reducing the first cost of cars, reducing the force required to brake the cars when going at a high speed, the impetus being less; reducing the force of concussion in case of accident, and hence the dangers and destruction to life and property consequent thereon; and, finally, permitting all bridges and other superstructures to be built more cheaply, more artistically, and less weighty than has heretofore been possible. Furthermore, for the same reason, and also because of the distribution of motive power attainable, greater speed may be acquired, sharper curves rounded with less than the usual wear, and steeper grades may be climbed. Experienced and trained engineers and firemen are not required to operate an electric railway. Any boy possessed of ordinary intelligence may be taught in half an hour to manage a car perfectly and cause it to perform all the work of a steam locomotive. This feature alone does away with a great soure of expense now incurred by all steam railways, whether elevated or surface. The electric system also admits of the use of large, stationary, protected steam engines of the most economical type. The use of these as against small, exposed, portable ones, reduces immeasurably the wear and tear, as well as first cost, and also the amount of fuel necessary to develop a given amount of power; and if water power be utilized—as would very frequently be possible—the cost of operating such a railway system can be reduced to a comparative minimum. Further advantages are—ability to get up speed quickly, which is particularly desirable for street and elevated roads; absence of noise, freedom from liability to many forms of accident now unavoidable, and from the annoyance of flying sparks, cinders, smoke, gases, grease, and the many other offensive and dangerous accompaniments of our steam railway system.

The time is now surely at hand for the economic and advantageous employment of electricity as a cleanly and cheap means of effecting rapid passenger transportation through densely populated cities and across the Continent. Jacobi, Davenport, Davidson, Little, Pinkus, and Page were in advance of the age in which they lived. No more rapid transit was demanded at that period of the world's history. The dynamo-electric machine which we have seen has rendered feasible the electric railway was not then in existence; hence they were obliged to apply electricity as a primary motor, an office which is filled far more economically by the sterm engine, as was shown by their contemporaries in science—those versed in mathematics and thermo-dynamics. Now, however, the time is ripe for its introduction. We have reached the period of transition from the stage of practical demonstration to that of practical application. We now know how to apply electricity as a *secondary* motor; the dynamo-electric machine has been introduced as an industrial feature of our age; the project of electric railway transportation *now* has the sanction and enthusiastic support of the learned in the sciences of electricity, dynamics and mathematics; and, lastly, we live in an age which demands more rapid transit. We think fast, and live fast, and this naturally begets an almost insatiable desire and necessity to travel fast. Railroad managers are expected to provide the means of gratifying this desire with safety to passengers and without detriment to their earnings, if possible, but at all hazards to put trains through according to the latest and fastest schedule. For a number of years the regular time between New York and Chicago has been 36 hours, or a speed of 25 miles an hour, including stops. This is not what might be called slow; but the impatient public is more than ever impressed with the idea that "time is money," and that something better than this should be accomplished, in view of the improvements in rails, roadbeds, and rolling stock. Managers, in order to meet this demand, are put to a terrible strain. They must provide the ways and means, head off competition, take the responsibilities and risks of accidents, and, what is more important than all, they must make the traffic pay.

This last requisite, in the face of rival fluctuating rates, the enormous dead weight of locomotive and tender, of sleeping and drawing-room cars, and the excessive wear and tear of track, superstructure and rolling stock, from the increased weight necessary to effect such rapid transit *with the steam system*, is not an easy thing to repond to. Managers, master mechanics and carbuilders have for a long time regarded the rapidly increasing weight of trains as a growing evil that should be checked to prevent expenses from swallowing up earnings in passenger traffic. Fast running under existing conditions is extremely hazardous, as well as expensive, and this simply because of the enormous weight given to railway trains. The tractive force of twenty to sixty tons exerted by the driving wheels of a locomotive on an eighth of an inch of rail soon tears a tramway to pieces. These conditions are practically reversed in the writer's electric railway system. It might almost be said that here the lighter the rolling stock the greater the possibilities as to speed. Calculations based on the numerous points of advantage herein specified show that an electric railway may be operated at an average speed of sixty miles an hour for one-third the cost of operating by steam at the same speed.

If the train system must be discarded as least calculated to develop the advantageous qualities of electricity as applied to railway propulsion, then a practical method of applying this power upon each car must be devised, and this has by many eminent engineers been found to be no easy matter, but, on the contrary, a most complex question, fraught with many difficulties. The armature of the electric motor must run at a high speed, and its power must be transmitted to the wheels of the car by a *positive* gearing. All forms of belting were at first sight seen to be entirely impracticable, while gear wheels between parts moving differently were not to be considered. Everything electrical and mechanical, including that fundamental law of mechanics which directs that power shall in every instance be applied as *directly* as possible, seemed to point toward a direct application to the wheels. But how was this to be accomplished? As we have before noted, the armature or revolving part of the electric motor must move at a very high speed, entirely too high for the speed of a car wheel. And, furthermore, it is very evident that it was impossible to construct an "armature" upon the modern dynamo principle which should also serve as a car wheel—such a dual function was out of the question. And yet it was imperative that the principle of the motor should be that of the most efficient type of the modern dynamo.

However carefully the reader may examine into our simple solution of this question, no adequate conception can be formed of the amount of thought and work which has been bestowed upon it.

We have succeeded in applying the power directly to every wheel, to the point of traction, where the power is absorbed, the work done, and yet our wheel is neither an "armature" nor a "field" of a dynamo. It is both combined! In other words, every wheel is a dynamo in itself. Each wheel is *animated*, having power within itself. Hence, every wheel becomes a veritable locomotive.

—— The Bridgeport *Post* says that there's nothing on earth so mysteriously funny as a newspaper advertisement. The prime, first, last, and all the time, object of an advertisement is to draw custom. It is not, was not, and never will be designed for any other human purpose. So the merchant waits till the busy season comes and his store is so full of customers he can't get his hat off, and then he rushes to the newspapers and puts in his advertisement. When the dull season gets along and there is no trade and he wants to sell goods so bad he can't pay his rent, he takes out his advertisement. That is, some of them do, but occasionally a level-headed merchant puts in a bigger one and scoops all the business, while his neighbors are making mortgages to pay the gas bill. There are times when you couldn't stop people from buying everything in the store if you planted a cannon behind the door, and that's the time the advertisement is sent out on its holy mission. It makes light work for the advertisement, for a chalk sign on the sidewalk could do all that was needed and have a half holiday six days in the week, but who wants to favor an advertisement? They are built to do hard work, and should be sent out in the dull days when a customer has to be knocked down with hard facts and kicked insensible with bankrupt reductions ond dragged in with irresistible slaughter of prices before he will spend a cent. That's the aim and end of an advertisement, and if you ever open a store, don't try to get them to come when they are already sticking out of the windows, but give them your advertisement right between the eyes in the dull season, and you will wax rich and own a fast horse, and perhaps be able to smoke a good cigar once or twice a year. Write this down where you'll fall over it every day. The time to draw business is when you want business, and not when you have more business than you can attend to already.

New Single-Liquid Battery.

In the new battery of Buchin, Tricoche et Cie, a rod of amalgamated zinc forms the positive, and several rods of carbon the negative pole, the liquid being a weak acid or basic solution, such as that of sulphuric acid, of a bisulphate or acid sulphate, of hydrochlorate of ammonia, or of sea salt. The carbon is said to be so modified all through its substance during manufacture that hydrogen cannot accumulate on its surface; but the gas is obliged to pass off as generated, thus avoiding polarization. This new battery, the E.M.F. of which is 1.15 volt, is claimed to be capable of working for an almost indefinite period, so long as the liquid lasts, to occupy little space, to be of easy management, and to be cheap, both in first cost and maintenance. It has, however, a high internal resistance when required to give out a large quantity of current, as in the case of electric lighting. This is attributed by the inventors to the fact that the hydrogen, on being disengaged, in raising up the carbons forms a layer of gas which opposes the current. They hope, however, to be able in time to counteract this disadvantageous action.

The Cholera and Electricity.

A visitor to a cholera hospital of Paris was told by the physician in charge that he had been trying both continuous currents of electricity and ice, and that the former had done good work. The employment of electricity in such cases is by no means new, for in a book by the late Mr. Alfred Smee, F.R.S., entitled "Elements of Electro-Biology," and printed in 1849, the writer mentions that the alimentary canal is very easily affected by a current of electricity, and continues: "I have heard that electricity has been advantageously employed at the Free Hospital to rally a patient in the collapsed stage of cholera—a fact which I mention here, as this disease involves to a great extent the functions of the alimentary canal."—*London Electrical Review.*

—— The Electric Light and Power Company, St. Joseph, Mo., has made many marked improvements during the past year. The company is composed of local capitalists, and the best evidence that they are satisfied with the investment is the fact that when the capital stock was recently increased from twenty-five to fifty thousand dollars, the old stockholders took the entire new issue, not a single share being thrown upon the market. The company has seven miles of wire. The Thomson-Houston electric machine is used. Its capacity is ninety-five lights, all of which are burning and subscribed.

ELECTRIC LIGHT NEWS

—— Electrical footwarmers for use in railroad carriages are undergoing experiment by M. de Meritens at his works in the Rue Boursalt, Paris.

—— A commission has been appointed by M. Cochery to determine the conditions necessary for laying electric cables suitable for transmitting currents of high tension.

——In the new mansion built by the Marquis of Bute on the site of the old Mount Stuart House, Isle of Bute, Scotland, provision has been made for 400 electric lamps, and wires have been laid for conducting the electric current into every room. For several months the workmen have employed the new light to enable them to push on rapidly with the finishing of elaborate interior ornamentation.

—— The annual meeting of the stockholders of the Alpena Electric Light Company was held at the company's office, Jan. 23d. The following gentlemen were elected directors for the ensuing year: W. H. Johnson, A. W. Comstock, W. E. Rogers, W. H. Potter, Albert Pack, George L. Maltz and F. W. Gilchrist. At the directors' meeting, A. H. Johnson was elected President, A. W. Comstock, Vice-President and Treasurer, W. E. Rogers, Secretary and Manager.

—— Several different systems of electric lighting are in vogue in French private houses, but, says *La Nature*, they are all somewhat costly. One of the best systems is that of Gaston Menier, in which 150 Swan lamps are used, supplied by a series of 22 accumulators. These nominally yield from 40 to 50 amperes, which are sufficient to supply 60 lamps at a time—a number more than sufficient for any ordinary purpose. The accumulators are charged each day by a continuous current Gramme machine, regulated by resistances introduced into the circuit. The machine is driven by a 5 horse-power "Otto" gas engine. With a little practice, the servant who has charge of the lighting can, it is said, estimate the consumption pretty accurately, and re-charge the accumulators; allowing an excess of 10 or 12 per cent. for loss—possible errors. When it is necessary to use all the lamps, the direct supply from the machine is added to that of the accumulators.

A new portable electrical gas lighter has been devised by Mr. Ullmann, in which the spark is produced not by an induction coil actuated by a battery, but by the conversion of the mechanical force exerted by the hand upon a button. For this reason the arrangement is called by its inventor, an everlasting gas lighter. The exterior appearance of the apparatus, as published in *La Nature*, exactly resembles that of the battery lighters already introduced, the working parts being enclosed within a vulcanic handle, and the spark emanating from metallic points at the end of a suitable rod. The handle contains an inner concentric tube, which is caused, by proper gearing, to rotate rapidly when the button is firmly pressed; and by this rotation a small statical electrical machine is constituted, which in due course charges a tiny fixed induction coil, whereby the spark is caused to appear at the interrupted portion of the circuit. The apparatus therefore works upon the principle of Sir W. Thomson's "replenisher." The perfect operation of the arrangement is much facilitated by the fact that the electrical portion of it is hermetically enclosed in a suitable case, the enclosure, being also kept dry by the insertion of a small quantity of absorbent material. We understand that the Domestic Electric Company of Boston are manufacturing them.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JANUARY 27, 1885.

311,166 Electric light tower; John S. Adams, Elgin, Ill., assignor to the Detroit Iron Tower Company, Detroit, Mich.

311,174 Electric cable; Henry A. Clark, Boston, Mass.

311,218 Printing telegraph; John E. Wright, New York, N. Y., and J. Holmes Longstreet, Hoboken, N. J.

311,234 Electric clock; Augustus S. Crane, Newark, N. J.

311,236 Method of preparing the elements of storage batteries; Asahel K. Eaton, Brooklyn, N.Y.

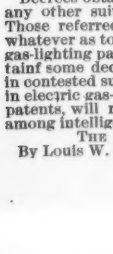
311,330 Telegraphic repeater; Joseph Kölzer, Duisberg, Prussia, Germany.

311,381 Electrical exercising apparatus; James H. Shaw, New York, N. Y.

311,398 Electric lamp fixture; Edward Weston, Newark, N. J.

311,445 Secondary battery, or electric accumulator; Simon Phillippart, Fils, Paris, France, assignor to the Electrical Storage Power Company (Limited), London, England.

E. W. HAZAZER,
MANUFACTURER OF
ELECTRIC BELLS
Annunciators, Window Springs, Burglar Alarms, and Gas Lighting Apparatus.



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Business Notice.

DIRECTORS' OFFICE OF THE ELECTRIC GAS LIGHTING COMPANY, 45 MILK STREET.
BOSTON, Mass., Jan. 30, 1885.

DEAR SIR:—Mr. A. L. Bogart has invited certain dealers in Electric Gas Lighting apparatus to account to him as infringers, upon the strength of certain decrees of the U. S. Circuit Court for the Southern District of New York.

As Mr. A. L. Bogart omits to explain *how* his decrees were obtained, we beg to state that this company brought suits in equity for injunction and account against Mr. A. L. Bogart, upon its Letters Patent covering electric hand-lighting devices, and completed its *prima facie* testimony long ago. We are trying to have this case prepared for final hearing.

Some time after this suit was instituted against Mr. A. L. Bogart, he brought cross suits against a former agent of this company. We offered to furnish counsel and assume the defense, but the offer was refused. We could not, under the law, force ourselves into, or be heard in these suits against another party.

As anticipated, however, these cross suits were not contested, nor was any evidence, even, taken! Mr. A. L. Bogart's decrees were obtained by consent of the defendants. They by no manner of means determine the questions of infringement at issue between him and this company.

Decrees obtained by consent are not authority in any other suits, or between any other parties. Those referred to certainly have no significance whatever as to the real controversy over electric gas-lighting patents, and until Mr. A. L. Bogart obtainf some decrees upon the merits of his patents in contested suits, his threatening letters to dealers in electric gas-lighting apparatus, made under our patents, will not be likely to have much weight among intelligent people.

THE ELECTRIC GAS LIGHTING COMPANY.
By Louis W. Burnham, President.

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